Attachment A

People Mover Study

ARCADIS | IBI GROUP

Prepared for City of Whittier
by Arcadis IBI Group
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Executive Summary

Purpose and Background

The genesis of this study dates to March 2019, when Brookfield Development sought to amend their Development Agreement for their project, The Groves, at the former Nelles property in Whittier. As part of the amended agreement, Brookfield agreed to help fund a study of potential routes for a small-scale circular transit route that would connect The Groves Development, PIH Health Hospital, Whittier College, Uptown, and Hellman Park. Brookfield also arranged a presentation to City Council on their partnership with Optimus Ride, a provider of shared autonomous vehicles.

As the first few phases of The Groves residential and commercial developments have been completed, City Council initiated the study of potential routes for a “people mover” circulator – the phasing in of a new alternate fueled automated transport system to bring shared ride innovation to the Uptown Whittier area.

Objectives

Providing greater mobility access for residents to existing and emerging commercial areas, educational and medical facilities, and employment sites is a priority for the City’s leadership. To meet the accessibility needs of the residents, the city is interested in exploring the viability of an electric automated people mover to operate throughout the Uptown Whittier area connecting the Groves in Whittier, Whittier Marketplace, Hellman Park, Uptown Whittier, Whittier College and PIH Health Hospital (site for potential future Metro light rail station).

In addition to opportunities to provide additional mobility options, a Whittier People Mover service may: reduce the use of single occupancy vehicles; reduce vehicle miles traveled (VMTs); reduce greenhouse gas (GHG) emissions; and address congestion and parking challenges.

Defining the Study Area

Foundational to profiling existing transportation conditions and current land use considerations, such as planned development that may impact travel demand in the city is that of defining the area of service for a potential future people mover (or sustainable circulator).

As illustrated in Figure ES.1, building on the core anchors of The Groves and Uptown, additional destinations (trip attractors/generators) include Whittier College, PIH Health, Hellman Park, The Quad, and higher-order transit.

The development of microtransit operational concepts will address connectivity of these sites and potential corridors, as illustrated below in Figure ES.1.

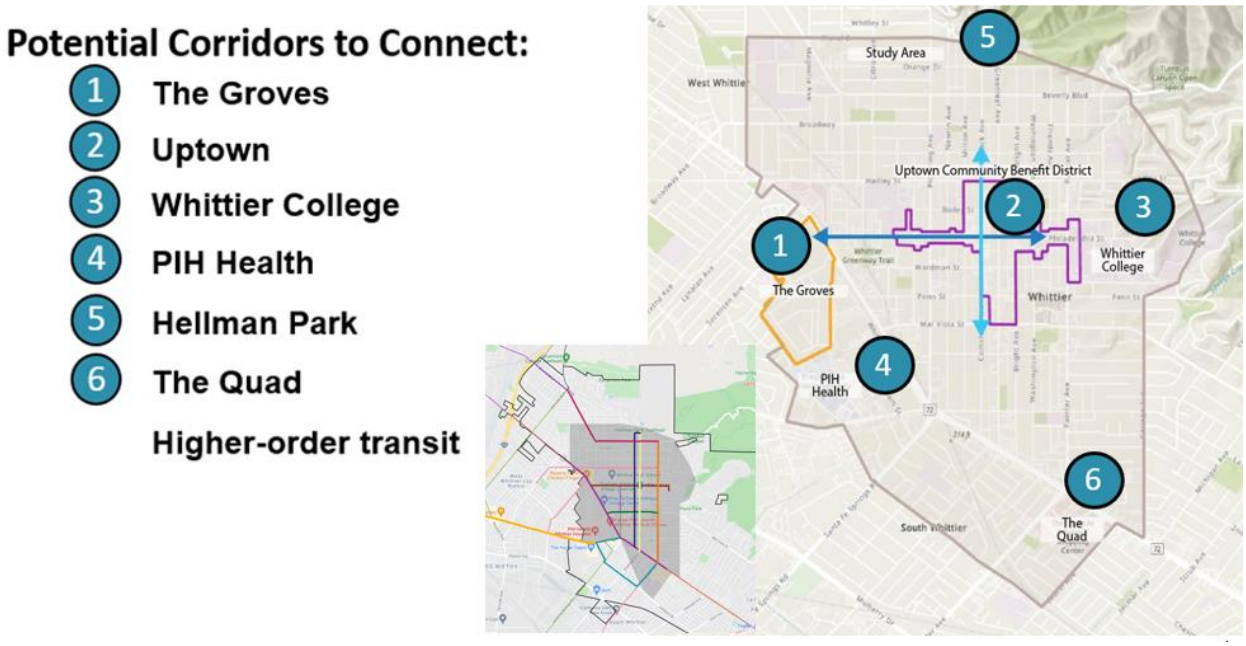


Figure ES.1: Potential Corridors for Connectivity

Existing Conditions - Analysis

The existing conditions captured in this report (such as traffic volumes, delay, and congestion points) do not preclude continued consideration of an automated people mover on any of the streets analyzed. Further consideration of streets will likely depend mostly on the operational capabilities of the vehicles themselves (such as their travel speeds and size) rather than on the streets. For example, small, low-speed automated vehicles would not be well suited to serve a higher speed arterial like Whittier Boulevard. Depending on the type of service envisioned, more detailed traffic engineering assessments will need to be completed to account for any potential reconfigurations of the street or curbs to accommodate its operation.

Given its connectivity between key activity centers, Philadelphia Street demonstrates potential for an east-west service corridor, with Hadley Steet serving as a potential alternate. Several north-south corridors such as Greenleaf Avenue or Comstock Avenue could be further considered, particularly due to their present use as low-speed, neighborhood-serving routes. Painter Avenue could also serve as an alternate north-south route due to its higher capacity.

From a land use standpoint, new development trends in Whittier indicate a shift toward less auto-centric and more mixed-use design. Although the current projects under development are unlikely to cause a catalytic shift in travel patterns, the potential redevelopment sites identified in the City's Housing Element update could make a large cumulative impact if they are realized. Further consideration of a people mover concept

will need to balance how effective it may be in the near term against how it may be useful to new residents in the future.

State of the Industry - Analysis

The case studies exercise revealed many key takeaways for potential deployment of an autonomous vehicle/shared people mover concept in the City of Whittier. They are organized into three primary categories and detailed below.

Technical Takeaways are related to the vehicles and the environments in which they operate. These include:

- It is important to select a vehicle that can meet the needs of its operating environment. Small driverless shuttles like the Olli that operate at lower speeds would not be a good fit for Whittier Boulevard but may be suitable for smaller neighborhood streets in the city.
- Operation of more advanced vehicles such as those used in Chandler, AZ or Arlington, TX require an extensive data collection and mapping effort to safely operate at higher speeds in a larger area. This would require an advanced partnership with a private operator.
- One of the principal limitations of AV deployments is the location of a maintenance facility. This can have major implications for the range and service area.

Governance Takeaways are related to the planning, implementation, and funding of the potential project. These include:

- Implementation of an AV program can be expensive. The City of Whittier may be able to add or improve traditional mobility options at lower cost. Additional funding through grants might be possible but may not cover the entire cost of the AV program.
- The City should evaluate its own procurement processes to understand if any restrictions or hurdles might complicate the purchasing/contracting process with potential vendors.
- Even with “turnkey” AV solutions that are mostly planned and operated by a private firm, the workload for cities to implement an AV program can be resource-intensive. The City should have a dedicated project manager who has sufficient time and capacity to oversee the program, as well as strong relationships with partner agencies and departments.
- The City of Whittier may need to implement an AV regulation to clearly define roles and responsibilities for how the system would operate.
- Insurance and liability for AV systems are complicated issues. The City’s legal department should be involved early in the process.

Acceptability and Social Perceptions Takeaways are related to expectations and community engagement/buy-in. These include:

- Should the City pursue an automated people mover concept, it would be vitally important to properly set expectations about what the service can do, what it cannot do, and what happens in response to a maintenance issue, crash, or other unexpected event.
- A crucial component of buy-in is identifying a community mobility need, making a clear case for how AVs can address the need, and engaging with the public early and often about the project to understand any concerns.
- Safety and reliability are of utmost importance to potential riders and should be considered frequently during the engagement process.

New Mobility: Transit agencies throughout the nation have been partnering with the private sector such as private microtransit companies, and real-time routing and dispatching software providers for many years. However, transit agencies are still assessing how best to position themselves in the shifting paradigm of mobility. Throughout this time agencies have experimented with replacing existing services, complementing current services, and adding new services. Given most of the operating cost in transit industry is attributed to direct driver employment and vehicle ownership, agencies have experimented with a variety of models, where they 1) operate a service on their own; 2) use a contractor to run their services; or 3) partner with TNC or Taxis and subsidize trip cost; There is no clear conclusion on the best model, and it varies largely on the type of service being provided and the ridership demography.

Further, the transit industry is witnessing a rapidly changing world fueled by internet age technologies. The power of the internet allows agencies to plan and deploy technologies at a rapid pace even in situations when multiple service providers are involved. A number of technologies/solutions have either been field tested as part of a pilot program or have been widely deployed. Solutions such as Mobility as a Service (MaaS)[1], while still having very limited deployments, promise a great future given their ability to bring different providers together under a common service model.

New technologies and renewed customer demand have yet to significantly change the fundamental economics of personal mobility and transit. There are examples of mobility services operating on a self-sustaining basis; however, these mostly exist in areas where market economics, corporate underwriting or advertising revenues are uniquely available to avoid the need for public subsidy.

In short, as the mobility landscape continues to evolve, connected travelers, continued advancements in transportation technologies, and private sector involvement present unprecedented opportunities for improving public transportation. In recent years, concepts such as microtransit and mobility-on-demand have helped agencies fill first and last mile gaps by developing and integrating unconventional modes into their services, engaging the private sector in the form of autonomous/connected vehicles, transportation network companies (TNCs), car-share, bike-share and other modes as alternative to private

[1] Mobility as a Service brings together a variety of transportation operators into a single ecosystem of mobility. Mobility as a Service (MaaS) platforms are digital platforms that support end-to-end trip planning, electronic ticketing, and payment services across all modes of public and private transportation. A MaaS user-centric app integrates the process of locating, booking, and paying for all the necessary transportation elements of a trip.

vehicles. However, while municipalities and transit agencies continue to experiment with new business models, new suppliers, and new technologies, there remain challenges related to providing cost-effective, efficient, and equitable service to all people.

Community Survey and Stakeholder Engagement

The goal of the Whittier Community Survey was to identify mobility needs, typical routes that people take to their destinations, barriers to travel and to using non-automotive forms of transportation, and opportunities to improve travel in the project study area.

Based on the information gathered, survey respondents are open to alternative modes of travel in the Whittier community. They are interested in technology to help assist them but may need more traditional information and outreach as well.

A series of stakeholder and public outreach events were conducted to inform on study objectives, analysis, identify community needs and concerns, and solicit feedback on mobility alternatives being considered.

Stakeholder meetings were held virtually with city staff responsible for invitees which included representatives from the business, retail, hospitality, health, education, social service, recreation, and development industries.

There was general consensus that exploring shared mobility solutions in the Uptown Whittier area/corridor was viewed favorably.

Identified needs included:

- Address congestion and parking challenges
- Need to reduce the number of single occupancy vehicles by providing alternative mobility options
- Need to provide better options for key market segments including retail workers, students and the elderly and disabled communities.
- Need to provide better connections to Metro and Montebello Bus services.
- Should consider later night service options for hospital workers.
- Concerns with some of the elements of PMoD service including if it used services such as Uber or Lyft, concern with safety and may preclude young people/youth from using the service.
- Several questions arose regarding the level of service (days of week, hours of day), fares, and specific ‘routes’ that might be served.
- In response to discussion of technology including the prospect of e-hailing, mobile payment, real-time information, etc., the need to address provisions for people who do not have a smart device or may not have a bank account and/or credit card.

The final outreach event was a public meeting held (in-person) on November 2, 2022 at The Commons on the grounds of The Groves. Following a presentation by city staff, a facilitated interactive session had attendees mark their preferences of select service attributes on poster boards.

Attendees echoed many of the comments previously shared including the need for enhanced weekend day and weekend evening mobility services, primarily for discretionary trips. Both autonomous shuttles and microtransit driver shuttles were viewed favorably.

Attendees suggested that Uptown was the primary corridor to serve.

Mobility Modes Considered

Informed by the analysis of the study area (Chapter 2), an understanding of the evolving mobility landscape (Chapter 3), and community and stakeholder input (Chapter 4), opportunities for going forward need to reflect a **matching of mobility service types with community needs**. Specifically:

- Provide a variety of connections to several destinations
- Provide first/last mile/multimodal connections and address gaps in the existing transportation/mobility network
- Provide service to a range of market segments including Groves residents, PIH Health patients/workers, Whittier College staff and students, the retail/hospital industry, recreation users of Hellman Park, etc.
- Provide automated zero-emission service as a demonstration project.

Service and Ridership Estimates for Mobility Options

The potential level of service and ridership estimates for implementing various service modes can be found in the following tables:

- **Table ES.1: Operating Span and Vehicle Requirements**: For each service mode presented, operating span reflects the days of week and hours of day of operation, the number of operating hours and an identification of the number of vehicles required to service the identified operating span.
- **Table ES.2: Coverage Hours and Ridership Estimates:** Based on the operating span, coverage hours presents the number of annual hours of service, foundational for generating low and high ridership estimates.

Table ES.1: Operating Span and Vehicle Requirements

Service Area Size (sq. mi.)	Persons per Square Mile	Service Area Population	Service Mode(s)	Recommended Level of Service - Mon. - Fri.	Recommended Level of Service - Sat., Sun. & holidays	Operating Span Weekday (hours)	Operating Span Saturday (hours)	Operating Span Sat/Sun/Hol (hours)	Weekday Vehicles in Service	Saturday Vehicles in Service	Sat/Sun/Hol Vehicles in Service
1.90	8,421	16,000	Personal Mobility on Demand	5AM - 6AM, 10PM - 12AM	7PM - 12AM	3	0	5	2	0	2
			Fixed Microtransit - driver operated	9AM - 10PM	8AM - 7PM	13	0	11	1	0	1
			Flexible (on-demand) Microtransit	6AM - 10PM	8AM - 7PM	16	0	11	1	0	1
			Fixed Microtransit **Autonomous Vehicle**	9AM - 10PM	8AM - 7PM	13	0	11	1	0	1

Table ES.2: Coverage Hours and Ridership Estimates

Service Mode(s)	Annual Coverage Hours	Capacity per Coverage Hour	Maximum Annual Service Capacity	Low Demand	High Demand	Low Annual Ridership Estimate	High Annual Ridership Estimate
Personal Mobility on Demand	2,650	4	10,600	0.33	0.50	3,498	5,300
Fixed Microtransit - driver operated	3,953	8	31,624	0.50	0.67	15,812	21,188
Flexible (on-demand) Microtransit	5,265	4	21,060	0.50	0.67	10,530	14,110
Fixed Microtransit **Autonomous Vehicle**	3,953	8	31,624	0.50	0.67	15,812	21,188

Recommendations – *A Way Forward*

Based on study outcomes reflecting key elements of a mobility ecosystem, the following presents a preferred conceptual plan for advanced mobility services in the Uptown Whittier study area.

1. **Autonomous/Connected Vehicle Pilot:** A concept of operations (presented in Appendix 3) for an *Autonomous/Connected Vehicle Pilot* involves a preliminary framework with an emphasis on developing the systems, processes, and infrastructure for a successful service. Implementation of AV service would be limited to one main thoroughfare within the city – Philadelphia Street providing connectivity between The Groves, Uptown and Whittier College.

2. **Flexible Microtransit and Personal Mobility on Demand (PMoD):** A common concern of community stakeholders was the need for transit service that is more responsive to the needs of transit-dependent persons traveling outside of peak commuting periods and the traditional daytime/early evening service span of many of the existing fixed routes in the study area.

   PMoD provides a mobility option that is more responsive to these community needs and offers higher quality of service during shoulder periods of the day. PMoD can be summoned on demand versus requiring customers to adhere to a low-frequency fixed-route schedule.

   Finally, because PMoD costs are based on service consumed - only accrue on a per-rider basis, low rider volumes can be served much more cost effectively as compared to extending microtransit hours of service.

   For these reasons, PMoD is proposed as a supplement to a scheduled microtransit pilot.

The recommended approach is designed to address:

- ✓ **Input from the community** - Community Survey and stakeholder consultation identifying the need for more direct service, enhanced connectivity to major trip destinations, later night service, etc.
- ✓ **Able to address multiple service types including:**
    - First/last mile feeder connections (connectivity to higher order transit);
    - Destination based service including major employers, hospitals, recreational sites, and commercial/retail corridors; and
    - Coverage-oriented transit/mobility in low-density corridors and neighborhoods.
- ✓ **Able to reduce single-occupancy vehicle travel, and hence the reduction of:**
    - Vehicle miles traveled (VMTs)
    - Traffic congestion
    - Greenhouse gas emissions and other air pollutants
    - Energy consumption
    - Demand for on-street parking

The deployment of alternate mobility services may also mitigate some of the congestion and parking challenges anticipated during the construction phase of the Greenleaf Promenade project.

Table ES.4 presents a summary of the service design alternatives and their attributes for each of the following:

1. Personal Mobility on Demand (PMoD)
2. Scheduled Microtransit
3. Flexible Microtransit
4. Vehicle Sharing (compliment to other service alternatives)

Table ES.4: Mobility Modes Considered

Service Alternative		Service Design Attributes					
		Service Description	**Vehicle Types**	**When Can I Use It?**	**How Do I Use It?**	**How Much Might It Cost?**	**Potential Application in Whittier Study Area**
	Personal Mobility on Demand (PMoD)	Low-capacity - individuals or small groups. On-demand (next vehicle available) +/or advanced booked	sedans, minivans, taxis, transportation network companies (TNCs) - like Uber, Lyft	Flexible: commuter peak hrs., late night "owl" service, 24/7. **Typically 15 to 30 minute response time.**	Reservations required: app based +/or phone call center	Typically **subsidized** taxi/TNC service. Fare may be $1. or $2.	PIH Health: shift workers - connectivity to higher-order transit.
	Scheduled Microtransit	Moderate capacity - fixed route, set schedule (shuttles, circulators) Like regular transit.	vans, shuttle buses, connected/ autonomous vehicles	Flexible: span & frequency range from defined periods (commuter peaks) to fixed route operating hrs. Primarily as feeders. **Typically would run every 30 to 60 minutes.**	Walk-up service. No booking.	Typically - regular transit fare	Philadelphia Ave. corridor - connectivity The Groves, Uptown, Whittier College
	Flexible Microtransit	Demand Response / On Demand - Moderate capacity, dynamic itinerary.	vans, shuttle buses, connected/ autonomous vehicles	Flexible: span & frequency range from defined periods (commuter peaks) to transit operating hrs. Dynamic in response to demand. **Typically 30 to 60 minute response time.**	Reservations required: app based +/or phone call center	Typically - regular transit fare	Throughout study area: key attractors/generators - The Groves, Uptown, Whittier College, PIH Health, Hellman Park, The Quad, and higher-order transit
	Vehicle Sharing	Bike share, car share, and ride share services - expand reach of fixed-route transit services	Bicycles, electric scooters, sedans	Flexible. **Typically available 24/7.**	Typically walk-up service. May be reservation based.	Typically - market rates.	Key achors: The Groves, Uptown, Whittier College.

1 Introduction

1.1 Purpose and Background

The genesis of this study dates to March 2019, when Brookfield Development sought to amend their Development Agreement for their project, The Groves, at the former Nelles property in Whittier. As part of the amended agreement, Brookfield agreed to help fund a study of potential routes for a small-scale circular transit route that would connect The Groves Development, PIH Health Hospital, Whittier College, Uptown, and Hellman Park. Brookfield also arranged a presentation to City Council on their partnership with Optimus Ride, a provider of shared autonomous vehicles.

As the first few phases of The Groves residential and commercial developments have been completed, City Council initiated the study of potential routes for a “people mover” circulator – the phasing in of a new alternate fueled automated transport system to bring shared ride innovation to the Uptown Whittier area.

1.2 Objectives

Providing greater mobility access for residents to existing and emerging commercial areas, educational and medical facilities, and employment sites is a priority for the City’s leadership. To meet the accessibility needs of the residents, the city is interested in exploring the potential for an electric automated people mover to operate throughout the Uptown Whittier area connecting the Groves in Whittier, Whittier Marketplace, Hellman Park, Uptown Whittier, Whittier College and PIH Health Hospital (site for potential future Metro light rail station).

In addition to opportunities to provide additional mobility options, a Whittier People Mover service may: reduce the use of single occupancy vehicles; reduce vehicle miles traveled (VMTs); reduce greenhouse gas (GHG) emissions; and address congestion and parking challenges.

Key study objectives include:

- Definition of a study area and identification of key activity centers with data collection and analysis to support the selected area and centers.
- Profile existing transit conditions in the study area.
- Review planned future conditions for public transportation alternatives, to guide the definition of mobility alternatives in the study area.
- Review of study area's socio-economic data, demographics, and employment, as well as existing land use patterns, and planned and approved developments.
- Review of how a People Mover could facilitate intermodal movement of people and connectivity to local bus routes, bike trails, local shopping malls, and light rail service.
- Outline ridership data for a People Mover service consistent with the California Air Resources Air Board’s California Climate Investments (CCI) quantification for Affordable Housing and Sustainable Communities (AHSC) Projects.

The study work plan encapsulates:

- **Investigation** – **Review and analyze** existing data and characteristics and trends in the study area.
- **Innovation** – **identify** and **analyze mobility solutions**, vet these with the community.
- **Solutions** – develop an **action** and **implementation plan**, describing proposed deployment plan and its benefits.

1.3 Structure of Report

This report is structured under the following chapter headings:

Chapter 2 Study Area – Existing Conditions

Chapter 3 An Evolving Mobility Landscape

Chapter 4 Community Survey / Stakeholder Engagement

Chapter 5 Mobility Modes Considered

Chapter 6 Evaluation of Mobility Options

Chapter 7 Recommendations – *A Way Forward*

Three appendices are included:

Appendix 1: Automated People Mover - State of Industry / Best Practices Summary

Appendix 2: Community Survey – Summary Report

Appendix 3: Concept of Operations (ConOps)

2 Study Area - Existing Conditions

This chapter presents existing conditions and plans in the City of Whittier that are most relevant to consider in evaluation of potential people mover concepts. Section 2.1 provides for a contextual overview including the City of Whittier, The Groves and Uptown. This section subsequently includes the defining of the study area as illustrated in Figure 2.1.

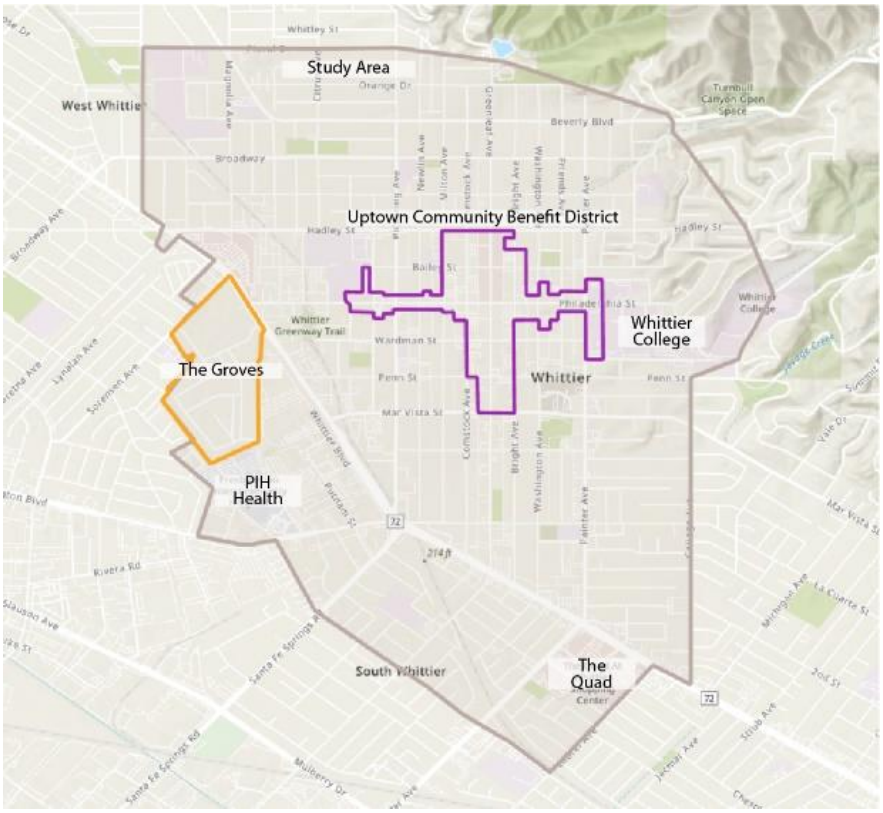


Figure 2.1: Study Area

Section 2.2 covers existing transportation conditions (such as transit facilities, traffic volumes, and congestion points) along the major roadways and key corridors considered in the study. Section 2.2 covers current land use considerations, such as planned development that may impact travel demand in the city. Section 2.3 concludes with a discussion of integrated transit and land use planning and key takeaways to consider for a potential future people mover.

2.1 Contextual Overview

The City of Whittier is located in southeast Los Angeles County, approximately 20 miles east of the City of Los Angeles. It encompasses 14.5 square-miles and a population of approximately 86,000 people. The Groves in Whittier is a new residential and commercial district consisting of 750-homes with commercial development. Its location is near the Uptown Whittier area.

Whittier has a history of attracting shoppers from the neighboring Los Angeles and Orange County communities. The "Shop Whittier" program, promoted by the Chamber of Commerce, is designed to promote and publicize the importance of shopping locally and keeping sales tax dollars within the city. With an average household income of $61,000+/- and 1.9 million population within 10 miles, Whittier offers excellent potential for expanding businesses to find just the right location in one of the city's key retail hubs; The Marketplace in west Whittier, Uptown in northwest Whittier, The Quad in central Whittier, Whittwood Town Center in East Whittier and the many Boulevard retail locations spanning from east to west Whittier. Businesses and industries in the area include 2,500 professional services, retail stores, hotels and motels, automobile dealerships and specialty shops and boutiques. Whittier is home to two colleges, Whittier College to the west and Rio Hondo College to the north.

2.1.1 The Groves

The Groves community site is the former Whittier State School, the oldest State School for juvenile offenders in the State of California. The Groves is a new community in Whittier set on over 75 acres at the intersection of Whittier Boulevard and Philadelphia Street. The Groves is comprised of 561 townhomes and single-family detached home designs, and 189 rental apartment homes.

The Groves at Whittier shopping center's +150,000 SF retail space has been fully leased and includes tenants such as Stater Brothers, EoS Fitness, In-N-Out, Raising Cane's, California Fish Grill, Chipotle, and CAVA.

Figure 2.2 illustrates the contextual site plan of The Groves.

Figure 2.2: Contextual Site Plan – The Groves

2.1.2 Uptown Whittier

Located just up Philadelphia Street from The Groves, Uptown Whittier is characterized by main floor retail uses which often have office/commercial uses on upper floors. The historic "Heart of Whittier" features specialty shops, a variety of indoor and outdoor dining opportunities and a considerable entertainment component with a historic restored multiscreen movie theatre complex and several live music venues.

Uptown is the historic retail core of the City of Whittier. The Uptown Specific Plan area covers approximately 185 acres and 35 city blocks, with each block measuring about 300 feet by 600 feet. One of the Plan's core principles is that of a healthy and livable town center design, including pedestrian orientation, mix of land uses, infill development, interconnected street system, quality of public realm, distinct character, housing choice, and smart transportation and parking.

Figure 2.3 illustrates the retail core concentration of the Uptown District on Greenleaf Avenue. The Greenleaf Avenue/Philadelphia Street intersection is viewed as a potential key attractor/generator for a people mover/microtransit service.

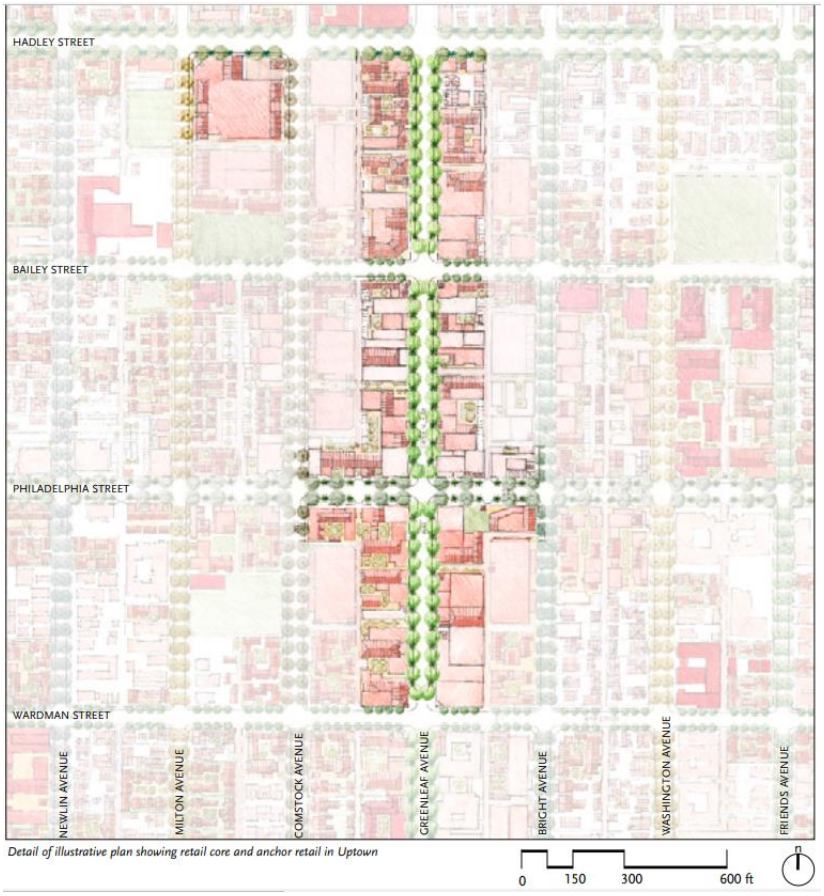


Figure 2.3: Uptown Whittier – Retail Core

2.1.3 Defining of Study Area

Foundational to profiling existing transportation conditions and current land use considerations, such as planned development that may impact travel demand in the city is that of defining the area of service for a potential future people mover (or sustainable circulator).

As illustrated in Figure 2.4, building on the core anchors of The Groves and Uptown, additional destinations (trip attractors/generators) include Whittier College, PIH Health, Hellman Park, The Quad, and higher-order transit.

The development of microtransit operational concepts will address connectivity of these sites and potential corridors, as illustrated.

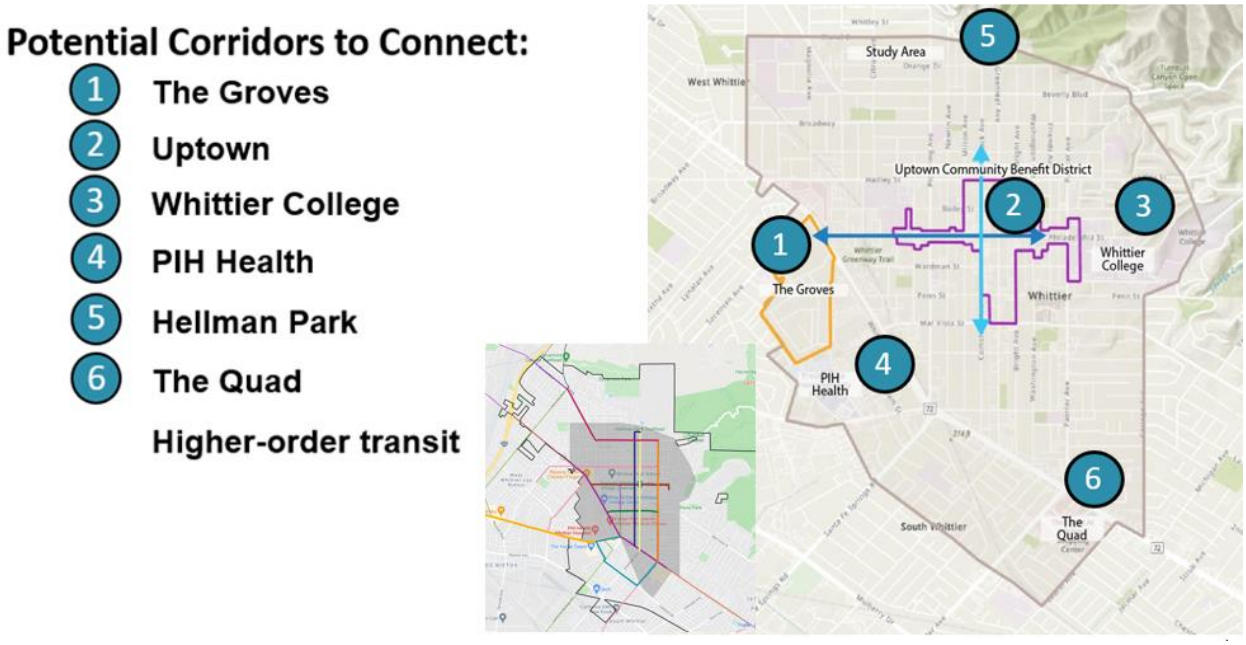


Figure 2.4: Potential Corridors for Connectivity

2.2 Existing Transportation Conditions

For the purpose of this report, information relevant to the study area was obtained from Fehr and Peer's 2021 Transportation Impact Analysis (TIA) for the Whittier General Plan, the City of Whittier's 2015 Lincoln Specific Plan, and the City of Whittier's Maps. Bus route information was obtained from the respective bus line websites.

Lincoln is a 75.6-acre community within the City of Whittier (henceforth referred to as "the City") and is located in the study area. The study area relative to the City of Whittier is smaller (less than half of the City's area). Therefore, the Transportation Impact Analysis (TIA) for the Whittier General Plan was reviewed and only data from within the boundaries of the study area was included.

2.2.1 Existing Roadway Network

Whittier Boulevard

Whittier Boulevard is the only major arterial to run through the City of Whittier. Whittier Boulevard has two (and periodically three) through lanes in each direction and stretches 6.4 miles from the San Gabriel Freeway (605 Freeway) in the City of Pico Rivera on the west to the City of La Habra at Valley Home Avenue on the east. Whittier Boulevard runs approximately 2.2 miles in the study area and includes six (6) signalized intersections. It is also a State Highway (Route 72) under the jurisdiction of the California Department of Transportation (Caltrans) District 7. As the only major arterial, Whittier Boulevard serves as the main commercial route for the city and functions as the primary distributor within the City's transportation network. There are no significant landmarks or property uses along Whittier Boulevard, besides shopping and medical centers, that would drive a significant amount of traffic.

Other Roadways

There are approximately 188.2 miles of streets, not including the 6.4 miles of Whittier Boulevard (Route 72), that are made up of major collector and local roads. In the study area, there are fourteen major streets: Palm Ave, Magnolia Ave, Pickering Ave, Friends Ave, Beverly Blvd, Broadway Blvd, Hadley St, Philadelphia St, Penn St, Mar Vista St, La Cuarta St, College Ave, Painter Ave, and Laurel Ave.

Philadelphia Street

Philadelphia Street is a secondary street sized for two travel lanes in each direction from Whittier Avenue to Greenleaf Avenue but has been reduced in capacity by a mixture of angled and standard curbside parking spaces east of Gregory Avenue. From Greenleaf Avenue to Painter Avenue it consists of one travel lane in each direction with angled parking in the Uptown Whittier area. East of Painter Avenue it transitions to a two lane local street with bike lanes as it travels along the northern edge of the Whittier College Campus. In addition to its connection to Whittier College, Philadelphia Street is important for its direct connection to the new commercial shopping center at The Groves, as well as Whittier High School, the Whittier Museum, the Shannon Center performing arts theater.

Mar Vista Street

Mar Vista Street is an east-west 4 lane secondary roadway west of Painter Avenue, where it consists of two travel lanes in each direction with a middle turn lane and bicycle lanes on both sides of the street. East of Painter Avenue it becomes a 2 Lane Collector with one travel lane in each direction, no bike lanes or turn pockets, and curbside street parking on the north side of the street only. Mar Vista Street is mostly fronted by single family and multifamily residential but does travel past activity centers such as the DoubleTree by Hilton hotel and the City of Whittier Civic Center and Friends Park complexes.

Greenleaf Avenue

Greenleaf Avenue is designated as a 4 lane minor street south of Mar Vista Street but generally features one travel lane in each direction with a center turn lane and curbside parking. North of Mar Vista Street, Greenleaf Avenue is a 2 lane secondary street with one travel lane in each direction and angled street parking. It is a major north-south commercial street connecting Whittie Boulevard on the south end to shops and

restaurants in the Uptown Whittier District. To the north, it travels through residential neighborhoods to connect to the Hellman Park Trailhead. In response to the COVID-19 pandemic, approximately two blocks of Greenleaf Avenue were closed to auto traffic and opened for pedestrian movement and outdoor dining.

Hadley Street

Hadley Street is an east-west 4 lane major street generally featuring two travel lanes in each direction with curbside parking on both sides of the street and turn pockets at major intersections. It forms the northern border of both the Uptown Whittier Commercial District and Whittier High School and is fronted by a mixture of commercial businesses and single and multifamily residential land uses. East of Painter Avenue, Hadley Street becomes a slower residential street with one travel lane in each direction, bicycle lanes, and curbside parking.

Painter Avenue

Painter Avenue is a north-south street through the city, designated a 4 lane minor street south of Hadley Street and a 2 Lane Secondary north of Hadley Street. Although much of the street is fronted by residential land uses, it is the western boundary of Whittier College, the eastern boundary of the City of Whittier Civic Center and Friends Park complexes and connects to two commercial retail shopping centers at Whittier Boulevard.

Beverly Boulevard

Beverly Boulevard is the northernmost major street in Whittier, traveling northwest-southeast and east-west and generally consisting of two travel lanes in each direction between Interstate 605 and Pickering Street. East of Pickering Street it narrows to one travel lane in each direction with curbside street parking. Beverly Boulevard is mostly fronted by residential land uses, except for a collection of commercial retail plazas where it intersects with Norwalk Boulevard/Workman Mill Road.

Comstock Avenue

Comstock Avenue runs north-south and is immediately east and parallel to Greenleaf Avenue. In the Uptown Whittier district it generally features on travel lane in each direction with a variety of small commercial land uses and is also used to access many parking facilities. South of Wardman Street it transitions to a small neighborhood street with street parking, single-family residential, and a relatively high concentration of multifamily residential land uses. With the closure of traffic along Greenleaf Avenue, Comstock Avenue may be an important travel route for a potential APM.

Wardman Street

Wardman Street is a small east-west local road with a single travel lane in each direction and curbside street parking. It features a mixture of commercial and residential land uses and the offices of the Whittier City School District. Because Wardman Street is not a through street (dead-ending on the west end in a residential neighborhood and on the east end at Painter Avenue/Whittier College), its lower speeds and traffic volumes may make it a good candidate for a low-speed AV route.

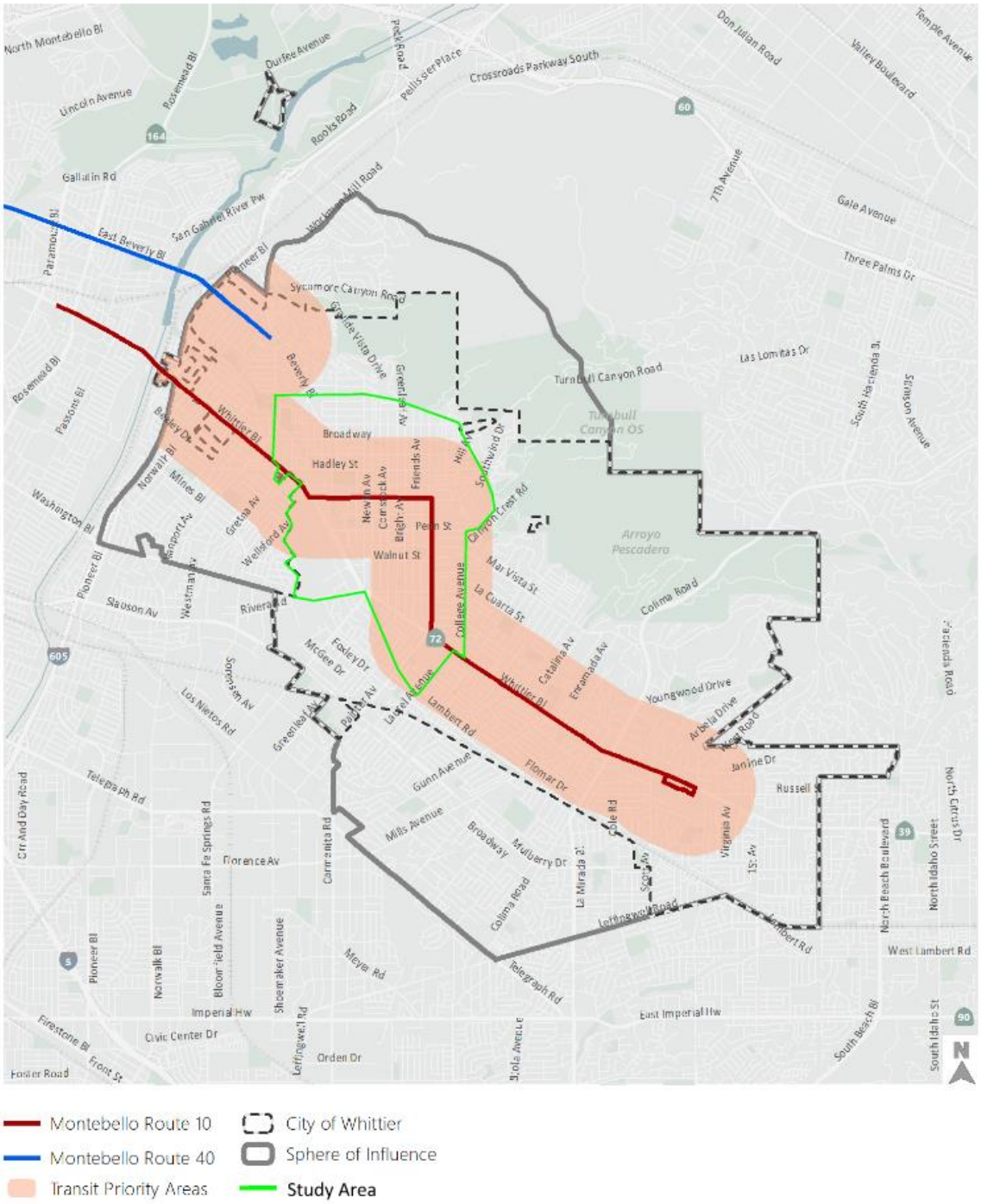
La Cuarta Street

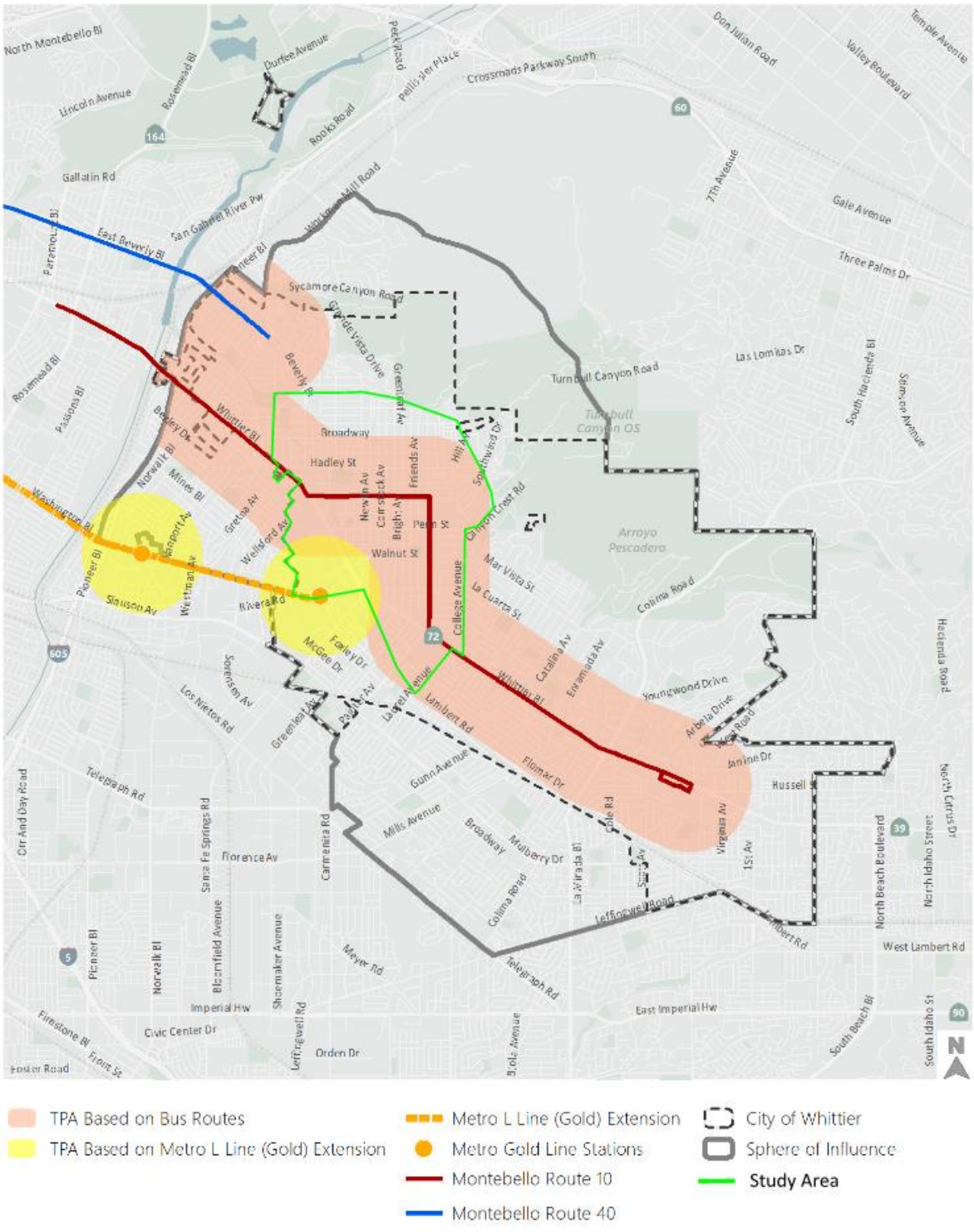
La Cuarta Street is designated as a 2 Lane Collector, featuring a single travel lane in each direction with curbside street parking. The street generally travels through residential neighborhoods, with limited commercial activity at Greenleaf Avenue and Painter Avenue. It also connects with three parks in the project study area, one of which is part of Jackson Elementary School.

2.2.2 Existing and Planned Transit Network

The City's current Transit Priority Areas are within one-half mile of where two or more bus routes with 15-minute frequency or better intersect or within one-half mile of a corridor served by 15-minute frequency or better bus service. With the expansion of the East side Transit Corridor Phase 2, the Transit Priority Areas would expand to include areas within one-half mile of the new stations at Norwalk Boulevard/Washington Boulevard and at Lambert Road/Washington Boulevard, as shown in Figure 2.6**.**

Bus services in Whittier include the Montebello Bus Line, the LA County Sunshine Shuttle, Norwalk Transit, Foothill Transit and Metro. Figure 2.5 shows the Montebello Bus Line Route 10 that runs along Whitter Boulevard. Other routes in the study area include Montebello's Route 50, Norwalk Transit's Route 7, and LA County Sunshine Route A. Route 10 is in service Monday – Sunday and varies in frequencies from 5 minutes to 30-minute intervals. Route 50 is in service Monday – Friday and varies in frequencies from 15 minute to 55-minute intervals. Route 7 is in service Monday – Saturday and varies in frequencies from 45 minutes to 70-minute on weekdays. On Saturdays, Route 7 runs in 60-minute intervals. Route A is in service Monday – Saturday and runs every 70 minutes.


Montebello Route 10
Montebello Route 40
Transit Priority Areas
City of Whittier
Sphere of influence
Study Area
Broadway
Hadley St
Penn St
Walnut St
Whittier Bl
Lambert Rd
Colima Road
Telegraph Rd
Imperial Hw
East Imperial Hw
Turnbull Canyon Road
Arroyo Pescadero
Turnbull Canyon OS
Beverly Bl
Pioneer Bl
Norwalk Bl
Rosemead Bl
Durfee Avenue
Crossroads Parkway South
Gallatin Rd
Las Lomitas Dr
Three Palms Dr
Gate Avenue
Youngwood Drive
Arbela Drive
Janine Dr
Russell St
Mills Avenue
Florence Av
Meyra Rd
Civic Center Dr
Orden Dr
Foster Road
West Lambert Rd
North Beach Boulevard
North Idaho Street
South Idaho St
South Beach Bl
Valley Boulevard
Temple Avenue
Don Julian Road
7th Avenue
Stimson Avenue
South Hacienda Bl
Mar Vista St
La Cuarta St
Colleges Avenue
Catalina Av
Fremont Av
Foxley Dr
McGee Dr
Los Nietos Rd
Greenleaf Av
Palmer Av
Laurel Avenue
Gunn Avenue
Mulberry Dr
La Mirada Dr
Cole Rd
Virginia Av
Carmenita Rd
Santa Fe Springs Rd
Bloomfield Avenue
Shoemaker Avenue
Lettingwell Rd
Viola Avenue
Front St
Firestone Bl
Stage Vista Drive
Greenleaf Av
Whittier Bl
Bexley Dr
Norwalk Bl
Mines Bl
Greta Av
Wellford Av
Newlin Av
Comstock Av
Bright Av
Friends Av
Southwind Dr
Canyon Crest Rd
Washington Bl
Passons Bl
Paramount Bl
East Beverly Bl
San Gabriel River Pw
Rooks Road
Pellissier Place
Lincoln Avenue
North Montebello Bl
Rosemead Bl
Sycamore Canyon Road
Stauson Av
Westman Av
Riverside
Transport Av
Pioneer Bl
Slauson Av
Los Nietos Rd
Telegraph Rd
Cir And Day Road
Santa Fe Springs Rd
Florence Av
Pioneer Bl
Norwalk Bl
Bloomfield Avenue
Shoemaker Avenue
Imperial Hw
Civic Center Dr
Firestone Bl
Front St
Foster Road
Lettingwell Rd
Orden Dr
Meyra Rd
Telegraph Rd
Lambert Rd
West Lambert Rd
Colima Road
La Mirada Dr
Mulberry Dr
Broadway
Mills Avenue
Gunn Avenue
Lambert Rd
Flomar Dr
Whittier Bl
Youngwood Drive
Arbela Drive
Janine Dr
Russell St
Virginia Av
15th Av
Colima Road
Colleges Avenue
Mar Vista St
La Cuarta St
Catalina Av
Fremont Av
Foxley Dr
McGee Dr
Los Nietos Rd
Greenleaf Av
Palmer Av
Laurel Avenue
Lambert Rd
Gunn Avenue
Flomar


TPA Based on Bus Routes
TPA Based on Metro L Line (Gold) Extension
Metro L Line (Gold) Extension
Metro Gold Line Stations
Montebello Route 10
Montebello Route 40
City of Whittier
Sphere of Influence
Study Area
Broadway
Hadley St
Penn St
Walnut St
Whittier Bl
Lambert Rd
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College Avenue
Mar Vista St
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Rivera Rd
Leffingwell Road
Telegraph Rd
Imperial Hw
East Imperial Hw
West Lambert Rd
Sycamore Canyon Road
Turnbull Canyon Road
Arroyo Pescadero
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Gunn Avenue
Florence Av
Mills Avenue
Mulberry Dr
Civic Center Dr
Orden Dr
Meyer Rd
Youngwood Drive
Arbela Drive
Hacienda Road
Russell St
North Beach Boulevard
North Idaho Street
South Beach Bl
South Idaho St
Gale Avenue
Three Palms Dr
Las Lomitas Dr
Rosemead Bl
Pioneer Bl
Norwalk Bl
Santa Fe Springs Rd
Carmenita Rd
Shoemaker Avenue
Bloomfield Avenue
Los Nietos Rd
Greenleaf Av
Foxley Dr
McGee Dr
Lincoln Avenue
Gallatin Rd
Rooks Road
Durfee Avenue
Crossroads Parkway South
Don Julian Road
Valley Boulevard
Temple Avenue
7th Avenue
Skyview Avenue
South Hacienda Bl
Parnell St
Passons Bl
Mines Bl
Gretna Av
Wellford Av
Stauson Av
Washington Bl
Cir And Day Road
Telegraph Rd
Foster Road
Firestone Bl
Front St
Orr And Day Road
Citrus Dr
Virginia Av
1st Av
Cole Rd
La Mirada Bl
Catalina Av
Esmeralda Av
Whittier Bl
Lorel Avenue
Pickering Ave
Greenleaf Av
Friends Av
Bright Av
Comstock Av
Newlin Av
Southwood Dr
Hillgrove Dr
Chipon Crest Rd
Sunset Av
Westman Av
Pioneer Bl
Rosemead Bl
Lincoln Avenue
Peck Road
Pellissier Place
Whittier Hills Road
San Gabriel River Pw
East Beverly Bl
Paramount Bl
Sycamore Vista Drive
Greenleaf Av
Hillgrove Dr
Southwood Dr
Chipon Crest Rd
Friends Av
Bright Av
Comstock Av
Newlin Av

2.2.3 Existing Traffic Analysis

Prior to the implementation of SB 743, transportation impacts for CEQA purposes were assessed by vehicle level of service (LOS). The Highway Capacity Manual defines LOS as a measure describing operational conditions within a traffic stream, generally in terms of speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. SB 743 guidelines now require the use of vehicle miles traveled (VMT) as the preferred transportation assessment metric. VMT, the measurement of the total milage traveled by all vehicles in an area or as a result of a project, is preferred because it shifts the analysis from impacts on the roadway networks to reducing greenhouse gas emissions. However, as the City is still working to integrate these new guidelines, LOS is still being used for projects that do not involve CEQA analysis. For this study area, both VMT and LOS are provided for the existing conditions.

2.2.3.1 Existing VMT (Vehicle Miles Traveled) Analysis

The Southern California Association of Government (SCAG) Regional Travel Demand Model was used to estimate VMT for the City of Whitter. This model is a 4-step, trip-based convergence model that is structured geographically into approximately 4,100 tier 1 Transportation Analysis Zones (TAZs) and 11,267 tier 2 TAZs. Socioeconomic data, highway network, and transit network information were inputted into the SCAG Model to estimate VMT based on the analysis being conducted, including “Home-Based VMT” per capita for residential land uses and “Home-Based Work VMT” per employee for employment land uses. Table 2.1 summaries the VMT values for the pre-COVID 2019 year.

Table 2.1: Existing (2019) VMT Summary

SED / VMT METRICS	2019 EXISTING CONDITIONS
Population	142,851
Employment	31,667
Service Population	174,518
Total VMT (include Auto and Trucks)	5,739,547
Home-Based VMT (Production)	2,314,225
Home-Based Work VMT (Attraction)	567,120
Total VMT per Service Population	32.9
Home-Base VMT per Capita	16.2
Home-Based Work VMT per Employee	17.9

Source: Transportation Impact Analysis (TIA) for the Whittier General Plan, 2021

2.2.3.2 Existing Vehicle LOS (Level of Service) Analysis

As stated in the Transportation Impact Analysis (TIA) for the Whittier General Plan, the Intersection Capacity Utilization (ICU) methodology was used for the signalized intersections, as the City of Whittier follows the Los Angeles County Traffic Impact Analysis (TIA) Report Guidelines to determine level of service. The ICU methodology provides a comparison of the number of vehicles passing through an intersection during a given hour to the theoretical hourly vehicular capacity of that intersection. A saturation flow rate of 1,600 vehicles per hour per lane for all through/turn lanes is used. The ICU calculation returns a volume-to-capacity (V/C) ratio that translates into a corresponding level of service (LOS).

In urban settings, LOS D or better is commonly considered the desired LOS (LA County General Plan, 2014) and Whittier has established LOS D as the desired LOS throughout

the City, with the exception of Transit Priority Areas and Uptown Whittier where a decrease in LOS is allowed in light of trade-offs associated with priority given to multimodal access, speed reduction for safety, opportunities for outdoor dining and walkability of selected areas.

Existing traffic volumes were taken from counts collected in September 2017 and were used to evaluate the 2019 level of service at four (4) signalized intersections in the study area. The peak hour periods evaluated were weekday morning, from 7:00 to 9:00 AM, and weekday evening, from 4:00 to 6:00 PM. Table 2.2 summarized the results of both peak hour scenarios per intersection.

As shown in the table, all intersections except one operate at LOS D or better under existing conditions. This intersection (at the convergence of Pickering Avenue, Santa Fe Springs Road, Washington Boulevard, and Whittier Boulevard) is located within the Transit Priority Area set by the future L Line (Gold) Extension and is on the edge of the TPA buffer for the Montebello Transit Route 10, so existing LOS is of less of a concern.

Table 2.2: Level of Service at Select Intersections

ROADWAY		PEAK HOUR	EXISTING	
			V/C	LOS
1	Pickering Avenue, Santa Fe Springs Road & Washington Boulevard, Whittier Boulevard	Weekday AM	0.915	E
		Weekday PM	0.964	E
2	Painter Avenue & Mar Vista Street	Weekday AM	0.732	C
		Weekday PM	0.852	D
3	Painter Avenue & Whittier Boulevard	Weekday AM	0.707	C
		Weekday PM	0.831	D
4	Laurel Avenue & Lambert Road	Weekday AM	0.859	D
		Weekday PM	0.832	D

Source: Transportation Impact Analysis (TIA) for the Whittier General Plan, 2021

2.2.3.4 Key Corridors Analysis

To better understand existing traffic conditions in which a potential people mover might operate, the technical team utilized Iteris' ClearGuide mobility software to analyze several key corridors in the City of Whittier. The ClearGuide platform uses data sourced from GPS devices (such as cell phones) to create visualizations of congestion, reliability, and safety.

The team selected corridors that connect major destinations in the city, as well as those that on which an APM might be considered for operation These included:

- **Whittier Boulevard** from Norwalk Boulevard to Michigan Avenue
- **Philadelphia Street** from Whittier Boulevard to Whittier College
- **Mar Vista Street** from Whittier Boulevard to College Street

- **Greenleaf Avenue** from Whittier Boulevard to Beverly Boulevard
- **Hadley Street** from Whittier Boulevard to Painter Avenue
- **Painter Avenue** from Beverly Boulevard to Lambert Street
- **Beverly Boulevard** from Monte Vista Drive to Beverly Hills Drive
- **Comstock Avenue** from Mar Vista Street to Beverly Boulevard
- **La Cuarta Street** from Michigan Avenue to Comstock Avenue

The ClearGuide platform was used to assess several factors that may impact potential operations of an APM, such as which roads have higher speeds, levels of congestion, or traffic volumes that may not be suitable for certain types of systems. A description of the metrics reviewed for the corridors is listed below.

Monthly Contours – Average Speed

This module illustrates average speed across a given corridor for each day over the course of a month. It illustrates how representative the Daily Contours module is for illustrating hot spots over a greater period of time. It can also illustrate days that were particularly busy due to special events or crashes and can compare weekdays to weekend days.

Daily Contour – Average Speed

This module illustrates average speed across a given corridor for a single day. The chart highlights specific cross-streets where congestion regularly occurs and at what times. Unless noted otherwise, Tuesday, October 5 was used for each corridor.

Average Delay

This module illustrates the average amount of delay in minutes experienced along the corridor during the month.

Average Flow

Average Flow describes the daily average traffic volume along the corridor during the month of October 2021. The results are displayed as a daily average. Due to technical limitations of the platform, average flow could not be generated for some of the smaller streets.

For the purposes of this report, the technical team used the month of October 2021 to represent current existing conditions, as traffic volumes have largely normalized after COVID-19-related lockdowns in early 2020 and widespread vaccination efforts beginning in early 2021. October is generally accepted as representative choice for traffic analysis because summer vacations have ended, schools are in session, and there are no major holidays. Whittier College had also resumed in-person classes in August 2021.

The primary corridors reviewed, and a general description of their characteristics are listed in Table 2.3.

Table 2.3: General Roadway Information

Corridor	Lanes	Speed Limits (mph)	Adjacent Land uses	On-Street Parking	Average Weekday Traffic Volume
Whittier Blvd.	4	35-40	Commercial	Curbside	26,500 – 45,000
Philadelphia St.	2	25-30	Commercial, Residential, Education, Civic	Angled and Curbside	6,536 – 6,895
Mar Vista St.	4	30-35	Residential, Civic, Hotel, Parks	Curbside	11,885 – 18,263
Greenleaf Ave.	4	25-35	Residential, Commercial	Angled and Curbside	8,094
Hadley St.	4	35-40	Residential, Commercial	Curbside	15,539
Painter Ave.	2-4	25-40	Residential, Civic, Education, Commercial	Curbside	26,395
Beverly Blvd.	2-4	30-40	Residential, Commercial	Curbside	15,426 – 33,750
Comstock Ave.	2	25	Residential, Commercial	Curbside	3,387
La Cuarta St.	2	25	Residential	Curbside	3,805

2.3 Demographics and Land Use

Key demographic information and land use considerations may be used to inform on an areas propensity to use transit or other mobility service such as a people mover.

The following heat maps were generated to inform of the study area's:

- Population density (Figure 2.7) presents the number of people per square mile.
- Zero-Vehicle Households (Figure 2.8) presents the percentage of households with no vehicle.

Figure 2.7: Population Density

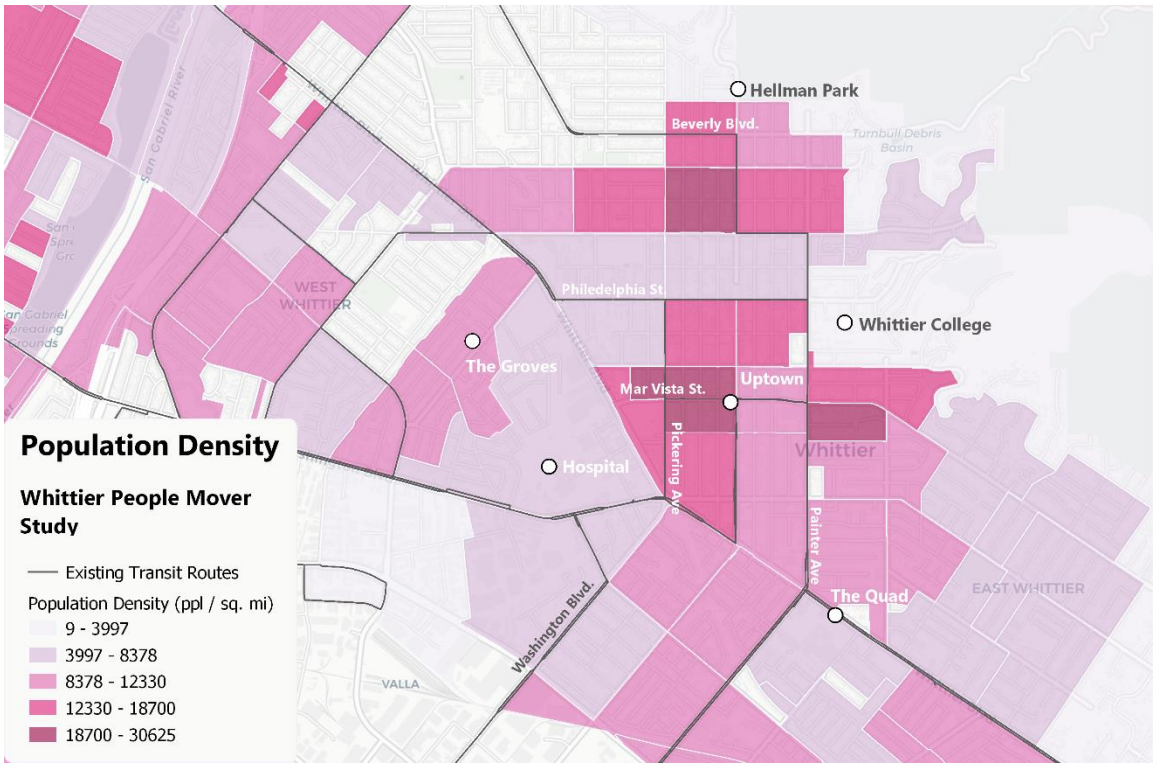
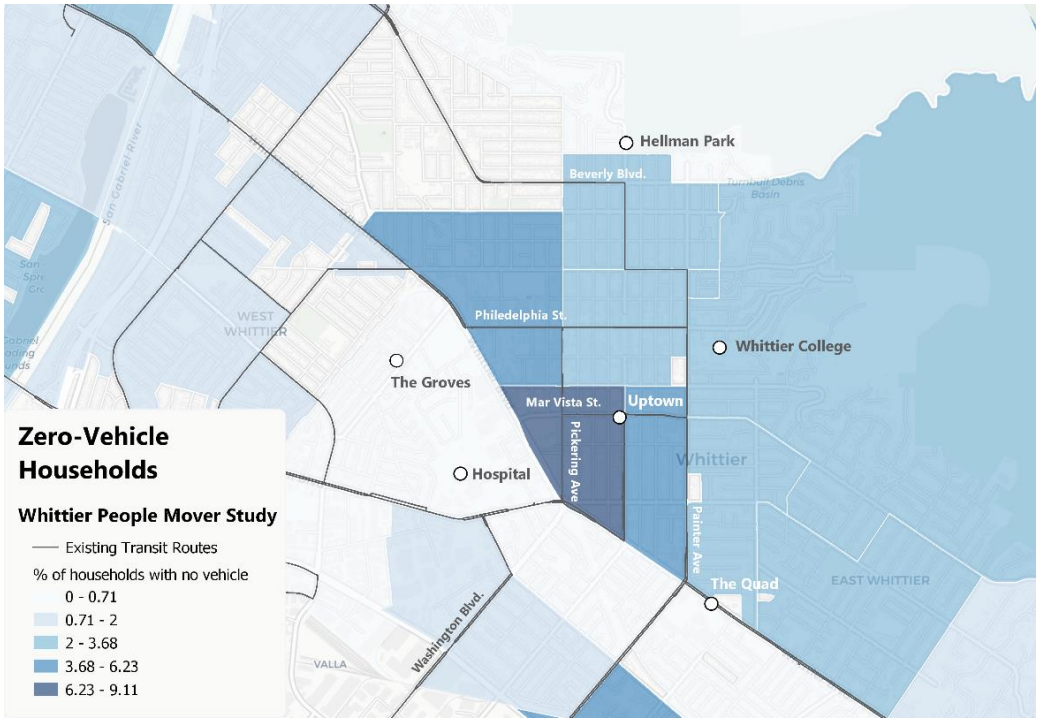


Figure 2.8: Zero-Vehicle Households



In terms of land use considerations, in general, compact, mixed-use, and higher-density development is better suited to addressing the affordable housing crisis and reducing the impacts of transportation on the environment. People are also less likely to use transit when it must travel long distances between destinations and when it is less convenient or reliable than car travel. This section discusses some of the major existing and planned land use considerations that may impact the successful delivery of the people mover project.

2.3.1 RHNA Update

All cities in California are required to submit regular Housing Element updates in response to the California Department of Housing and Community Development (HCD) Regional Housing Needs Allocation (RHNA). The RHNA process estimates where additional housing will need to be developed, and in response to its allocation the City of Whittier identified areas additional units could be accommodated under current zoning and where rezoning may be necessary. The City of Whittier's RHNA numbers are illustrated in Table 2.4.

Table 2.4: City of Whittier RHNA Allocations

INCOME GROUP	% OF COUNTY AMI	NUMBER OF UNITS ALLOCATED	PERCENT OF TOTAL ALLOCATION
Very Low	0-50%	1,025	29.9%
Low	>50-80%	537	15.7%
Moderate	>80-120%	556	16.2%
Above Moderate	120%+	1,321	38.5%
Total		3,439	100%

The City's certified housing element identified proposed projects with a capacity of 317 units, leaving the City with a remaining allocation of 2,867 units. The City further estimated that proposed projects and a variety of vacant or underutilized land could further meet development needs, resulting in a shortfall of 1,911 units. Rezoning could more than accommodate this shortfall providing capacity of up to 3,837 units.

2.3.2 Priority Development Areas and Opportunity Sites

Whittier has been the site of several new developments in recent years and is experiencing new infill development that is more supportive of transit use. This section includes a brief overview of some planned development in the city, as well as some potential sites for redevelopment that were identified in the Housing Element update.

Uptown Community Partners Site

Currently under negotiation between a development firm called Uptown Community Partners and the City of Whittier, this project seeks to redevelop 6.4 acres located north of Philadelphia Street and west of Bright Avenue in the Uptown District. It is project to include 229 for-sale residential units, 115 low- and very low-income rental units, and 5,000 square feet of commercial development. The project is located in the core of the potential people mover service area.

83315 Greenleaf Avenue

Located on a group of former industrial parcels that will be cleared during redevelopment, this project includes 17 detached condominiums on 1.21 acres on Greenleaf Avenue between Whittier Boulevard and the Whittier Greenleaf Trail. The development will be within walking distance of the L Line (Gold) Extension, and a people mover could potentially operate on Greenleaf Avenue.

Potential Redevelopment Sites

Table 2.5 illustrates key information about several properties identified in the City's Housing Element update, each of which could be redeveloped from largely auto-oriented, commercial retail purposes to mixed-use development with significant residential components. Although no firm plans are in place to redevelop them, each could support a more affordable, vibrant, and less auto-dependent Whittier.

Table 2.5: Potential Redevelopment Sites

NAME	LOCATION	SIZE	STATUS
Whittwood Town Center	Whittier Blvd & Santa Gertrudes Ave	66 acres	Owners considering redevelopment as mixed-use w/ major residential (1,282 units)
The Quad at Whittier Center	Whittier Blvd & Painter Ave	30.8 acres	Owners considering redevelopment as mixed-use w/ major residential (739 units)
Big Lots Center	Whittier Blvd & Painter Ave	3.6 acres	Opportunity for mixed-use redevelopment w/ 87 units of residential
Whittier Marketplace	Whittier Blvd & Hadley St	14.9 acres	Opportunity for mixed-use redevelopment w/ 358 units of residential

Figure 2.9 illustrates the locations of the developments currently in the planning and construction phases, as well as the locations where redevelopment could unlock a large transit-supportive mixed-use development.

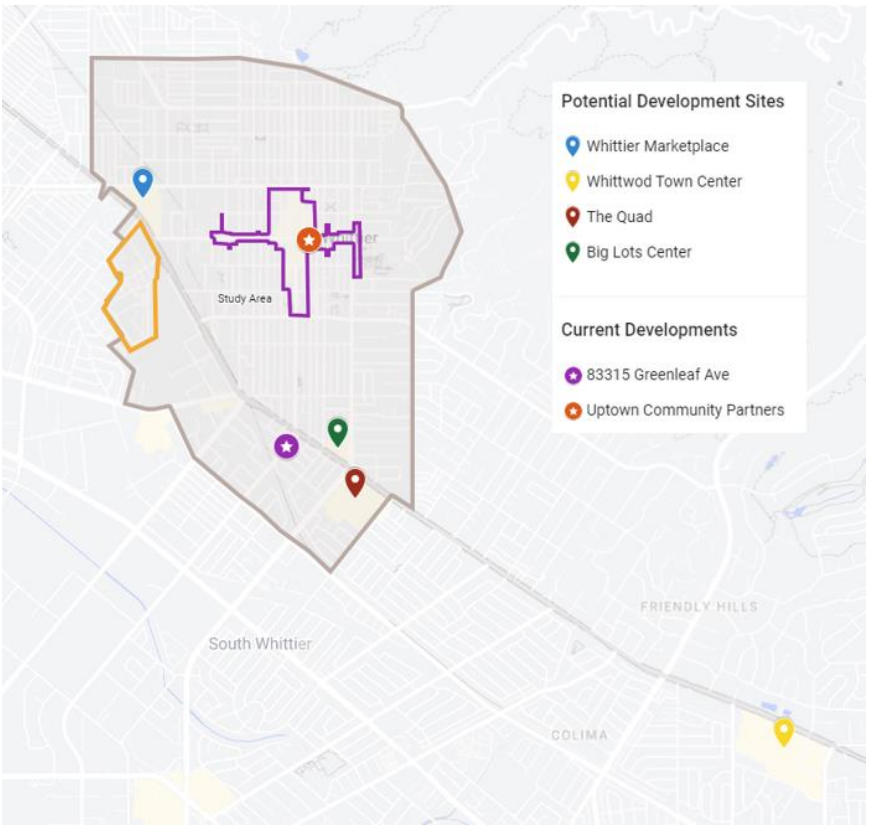


Figure 2.9: Current and Potential Redevelopment Sites

2.4 Analysis

The existing conditions captured in this report (such as traffic volumes, delay, and congestion points) do not preclude continued consideration of an automated people mover on any of the streets analyzed. Further consideration of streets will likely depend mostly on the operational capabilities of the vehicles themselves (such as their travel speeds and size) rather than on the streets. For example, small, low-speed automated vehicles would not be well suited to serve a higher speed arterial like Whittier Boulevard. Depending on the type of service envisioned, more detailed traffic engineering assessments will need to be completed to account for any potential reconfigurations of the street or curbs to accommodate its operation.

Given its connectivity between key activity centers, Philadelphia Street demonstrates potential for an east-west service corridor, with Hadley Steet serving as a potential alternate. Several north-south corridors such as Greenleaf Avenue or Comstock Avenue could be further considered, particularly due to their present use as low-speed, neighborhood-serving routes. Painter Avenue could also serve as an alternate north-south route due to its higher capacity.

From a land use standpoint, new development trends in Whittier indicate a shift toward less auto-centric and more mixed-use design. Although the current projects under development are unlikely to cause a catalytic shift in travel patterns, the potential

redevelopment sites identified in the City's Housing Element update could make a large cumulative impact if they are realized. Further consideration of a people mover concept will need to balance how effective it may be in the near term against how it may be useful to new residents in the future.

3 An Evolving Mobility Landscape

The technical memorandum detailing the *State of the Industry* specific to Shared Automated People Movers is presented in Appendix 1. This chapter provides a summary the state of the industry as well as providing a primer on 'new mobility'.

3.1 State of the Industry Summary

The autonomous vehicles field is changing rapidly, and yesterday's assumptions or knowledge may become rapidly outdated based on technological or regulatory changes. Since the beginning of this project, projects have been canceled or delayed due to the COVID-19 pandemic, economic uncertainties and supply chain issues, and at least one major supplier of vehicles shut down its operations. The goal of this memorandum is to document the study of recent autonomous vehicle deployments in cities and conditions similar to the City of Whittier, identify best practices and lessons learned from those deployments, and make recommendations based on the most current information available.

In order to accomplish that goal, the technical team reviewed relevant regulatory information for autonomous vehicle deployments, researched existing and planned deployments from around the United States, and conducted interviews with several public agencies who have deployed or are planning autonomous vehicle deployments. The team focused wherever possible on deployments that are happening on public roads, as this is expected to be the primary operating environment expected in the City of Whittier.

It is important to note the uncertainty of true deployment cost estimates as some of the vendors in the AV space are underwritten by venture capitalists that may be willing to take a long view on profitability.

3.1.1 Observations on Automated Shuttle Technology

The vehicles most commonly associated by most people with autonomous microtransit are the three shown in Figures 3-1a through 3-1c. These have featured prominently in pilot projects since 2016. As a class they are small, offering less capacity than the smallest vehicles most prevalently used in conventionally operated microtransit, and are battery electric. They have low floors and sliding doors to make boarding and alighting easier. In our opinion they represent a 'first generation' of vehicles purpose-built for autonomous operation and have limits on acceleration and top speed which make them unable to match performance with more conventional manually-operated vehicles in microtransit use in mixed traffic on urban streets. Their economic service life and robustness under transit duty cycles have not been clearly established.

Figure 3-1a. EasyMile EZ10

Figure 3-1b. Navya Autonom

Figure 3-1c. May Mobiliy

The performance limitation of the first generation vehicles is not likely to persist for long, as suggested by Figures 3-2a through 3-2c.

DR service is already being provided by RAPID with more conventional platforms equipped with AV technology. As of this writing, their fleet includes four hybrid electric Lexus vehicles and one battery electric Polaris GEM equipped to serve passengers with limited mobility.

Electric versions of conventional transit vehicles based on cutaway chassis such as the Ford Transit F350 are already commercially available. New England Wheels offers Frontrunner low-floor minibuses with sliding doors based on the RAM Promaster front-wheel drive family of vans and cutaway chassis.

At least two experimental programs with full size (40-foot) transit buses are underway with AV technology (battery electric in Singapore and hybrid electric Hartford, CT). These programs will explore operation on a controlled test network (Singapore) and into higher speed ranges on an exclusive busway (Hartford).

It is reasonable to surmise that within a handful of years, AV-equipped vehicles directly comparable with ones now in fixed-route shuttle and DR service will be available with features well suited for such service, derived from a large number of pilot tests.

Figure 3-2a. RAPID Arlington,TX

Figure 3-2b. Lightning eMotors

Figure 3-2c. New Flyer Excelsior AV

Given the likely convergence on vehicles with established 'transit' configurations, there remains an issue involving the economic sustainability of AV microtransit: the need for a person on board to be involved on occasion with the operation of the vehicle. The present state of AV operation is at Level 4 – High Driving Automation, which the Society of Automotive Engineers (SAE) characterizes as:

- "…does not require any human interaction in the vehicle's operation because it is programmed to stop itself in the event of system failure. Since a human driver is never needed, a Level 4 vehicle may not have a steering wheel and pedals"

- "…is for use in driverless taxis and public transportation services. Such vehicles will be programmed to travel between Point A and Point B and restricted to specific geographic boundaries by geofencing technology. Certain conditions may limit or cancel Level 4 autonomous vehicle operation, such as severe weather."

The present state of the art is some way away from not having a representative of the operating entity aboard. The AV microtransit projects which have released information suggest that about 75%-80% of trips are completed without human intervention in the driving task, and it should be noted that these are generally rather short trips compared to fixed route transit in general. The next stage to be reached is SAE's Level 4 – Full Driving Automation, at which point the fraction of trips not requiring intervention should reach 100%. We do not have an opinion to offer on when this goal may be reached, but we see no signs that it is imminent.

A particular responsibility which transit operations have is to assure that passengers board and alight safely. In the fixed guideway environment, there was a gap of about ten years between the adoption of automatic train operation between stations and driverless airport 'people movers' which managed station door operations. Prevalent industry opinion is that SAE Level 5 – Full Driving Automation, which would not be restricted to programmed localities, is unlikely prior to 2040.

3.2 New Mobility

Across the transit industry, there is a tremendous amount of innovation underway to develop new mobility options beyond conventional fixed-route bus and paratransit services. Many of these alternatives are enabled or enhanced by new technologies, such as mobile applications for trip discovery, booking, and fare payment. Transit agencies across the U.S. have been adapting these new mobility modes to better meet the needs of communities that are not particularly well-served by conventional fixed-route transit service.

New mobility captures a wide range of service modes and variations, including flexible and deviated-route microtransit, personal mobility on demand (PMoD), and car/bike sharing.

While the modes captured under the rubric of "new mobility" are diverse, they share certain common characteristics:

- **Smaller vehicle capacity**, ranging from 4-passenger sedans, cutaway buses (seating 12-15 persons) or autonomous people mover/connected vehicles. The smaller vehicle capacity makes these options more suitable for areas with low transit trip generation such as the Philadelphia Street or Greenleaf corridors, for example.
- **Customer responsiveness**, such as the ability to reserve rides or requesting a route deviation for a pick-up or drop-off. This provides increased convenience for the customer, such as the ability to access destinations out or reach of Metro or Montebello fixed-route bus stops, or to travel on a more flexible schedule.
- **Enabling Technologies** that makes service delivery possible, or at least more convenient. An example is the use of a mobile phone app to request a trip. That

said, peer transit agencies and third-party solution providers have developed tools to ensure that new mobility services are accessible to those who do not have access to such technologies. An example is the use of a call center to make a trip request rather than a mobile app.

- **Accessibility**, so that service is available to the largest possible number of users. While not always a complete substitute for conventional ADA Paratransit services, new mobility options can provide increased freedom of mobility for disabled travelers, such as more spontaneous same-day travel. An example is the use of lift-equipped vehicles, or the provision of door-to-door service that can overcome access barriers related to reaching a bus stop.
- **New Operating and Business Models** that may include central reservations and dispatch systems, new customer service interfaces, and operating schemes that hybridize aspects of fixed-route and paratransit/demand response operations. Some peer agencies have initiated operations in-house, using agency staff and agency-owned fleets and infrastructure; others have implemented new mobility through third-party providers such as microtransit operators, taxi companies, or transportation network companies (TNCs).

New mobility options can help to overcome some of the challenges to transit service delivery that are common in the Uptown study area. These challenges include:

- **Low transit trip generation**, due to development patterns, low density and other factors.
- **Dispersed origins and destinations**, such as arterial retail shopping centers, housing subdivisions, and industrial parks.
- **Poor first/last mile access** to bus stops due to lack of sidewalks, discontinuous street grids, etc.
- **Travel demand outside of traditional peak commuting hours** – for example, shift (PIH Health) and retail workers or Whittier College students.

3.3 Analysis

The evolving degree of automation suggests:

- The ‘first generation’ of autonomous electric AV shuttle vehicles is likely to be superseded in the near term by vehicles more compatible with existing transit fleets in terms of both acceleration and configuration.
- Shuttle systems serving trips within the City of Whittier are likely to have vehicle occupancies and productivity comparable with conventionally operated shuttle and demand response services. In short, ‘microtransit’ not ‘mass transit’.
- There is not a short-term prospect for AV shuttle services to be fully automated, *i.e.,* to not require an agent of the operating entity on board.

The case studies exercise revealed many key takeaways for potential deployment of an autonomous vehicle/shared people mover concept in the City of Whittier. They are organized into three primary categories and detailed below.

Technical Takeaways are related to the vehicles and the environments in which they operate. These include:

- It is important to select a vehicle that can meet the needs of its operating environment. Small driverless shuttles like the Olli that operate at lower speeds would not be a good fit for Whittier Boulevard but may be suitable for smaller neighborhood streets in the city.
- Operation of more advanced vehicles such as those used in Chandler, AZ or Arlington, TX require an extensive data collection and mapping effort to safely operate at higher speeds in a larger area. This would require an advanced partnership with a private operator.
- One of the principal limitations of AV deployments is the location of a maintenance facility. This can have major implications for the range and service area.

Governance Takeaways are related to the planning, implementation, and funding of the potential project. These include:

- Implementation of an AV program can be expensive. The City of Whittier may be able to add or improve traditional mobility options at lower cost. Additional funding through grants might be possible but may not cover the entire cost of the AV program.
- The City should evaluate its own procurement processes to understand if any restrictions or hurdles might complicate the purchasing/contracting process with potential vendors.
- Even with “turnkey” AV solutions that are mostly planned and operated by a private firm, the workload for cities to implement an AV program can be resource-intensive. The City should have a dedicated project manager who has sufficient time and capacity to oversee the program, as well as strong relationships with partner agencies and departments.
- The City of Whittier may need to implement an AV regulation to clearly define roles and responsibilities for how the system would operate.
- Insurance and liability for AV systems are complicated issues. The City’s legal department should be involved early in the process.

Acceptability and Social Perceptions Takeaways are related to expectations and community engagement/buy-in. These include:

- Should the City pursue an automated people mover concept, it would be vitally important to properly set expectations about what the service can do, what it cannot do, and what happens in response to a maintenance issue, crash, or other unexpected event.

- A crucial component of buy-in is identifying a community mobility need, making a clear case for how AVs can address the need, and engaging with the public early and often about the project to understand any concerns.
- Safety and reliability are of utmost importance to potential riders and should be considered frequently during the engagement process.

New Mobility: Transit agencies throughout the nation have been partnering with the private sector such as TNCs, private microtransit companies, and real-time routing and dispatching software providers for many years now, particularly since the MoD Sandbox initiative was launched by USDOT. However, transit agencies are still assessing how best to position themselves in the shifting paradigm of mobility. Throughout this time agencies have experimented with replacing existing services, complementing current services, and adding new services. Given most of the operating cost in transit industry is attributed to direct driver employment and vehicle ownership, agencies have experimented with a variety of models, where they 1) operate a service on their own; 2) use a contractor to run their services; or 3) partner with TNC or Taxis and subsidize trip cost; There is no clear conclusion on the best model, and it varies largely on the type of service being provided and the ridership demography.

Further, the transit industry is witnessing a rapidly changing world fueled by internet age technologies. The power of the internet allows agencies to plan and deploy technologies at a rapid pace even in situations when multiple service providers are involved. A number of technologies/solutions have either been field tested as part of a pilot program or have been widely deployed. Solutions such as MaaS, while still having very limited deployments, promise a great future given their ability to bring different providers together under a common service model.

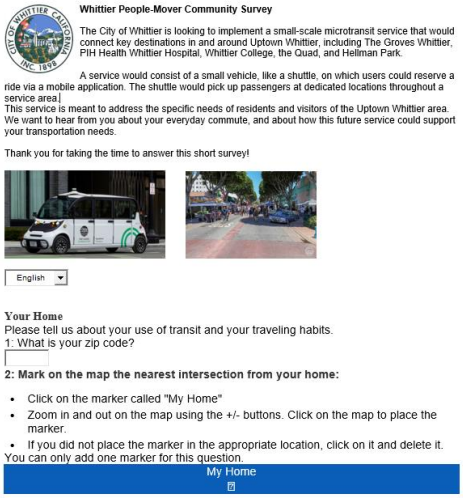
New technologies and renewed customer demand have yet to significantly change the fundamental economics of personal mobility and transit. There are examples of mobility services operating on a self-sustaining basis; however, these mostly exist in areas where market economics, corporate underwriting or advertising revenues are uniquely available to avoid the need for public subsidy.

In short, as the mobility landscape continues to evolve, connected travelers, continued advancements in transportation technologies, and private sector involvement present unprecedented opportunities for improving public transportation. In recent years, concepts such as microtransit and mobility-on-demand have helped agencies fill first and last mile gaps by developing and integrating unconventional modes into their services, engaging the private sector in the form of autonomous/connected vehicles, transportation network companies (TNCs), car-share, bike-share and other modes as alternative to private vehicles. However, while municipalities and transit agencies continue to experiment with new business models, new suppliers, and new technologies, there remain challenges related to providing cost-effective, efficient, and equitable service to all people.

4 Community Survey / Stakeholder Engagement

This chapter provides an overview of the community survey and stakeholder engagement activities.

Community Survey


Whittier People-Mover Community Survey

The City of Whittier is looking to implement a small-scale microtransit service that would connect key destinations in and around Uptown Whittier, including The Groves Whittier, PIH Health Whittier Hospital, Whittier College, the Quad, and Hellman Park.

A service would consist of a small vehicle, like a shuttle, on which users could reserve a ride via a mobile application. The shuttle would pick up passengers at dedicated locations throughout a service area.
This service is meant to address the specific needs of residents and visitors of the Uptown Whittier area. We want to hear from you about your everyday commute, and about how this future service could support your transportation needs.

Thank you for taking the time to answer this short survey!

English

Your Home
Please tell us about your use of transit and your traveling habits.
1: What is your zip code?

2: Mark on the map the nearest intersection from your home:

- Click on the marker called "My Home"
- Zoom in and out on the map using the +/- buttons. Click on the map to place the marker.
- If you did not place the marker in the appropriate location, click on it and delete it.

You can only add one marker for this question.
My Home

The Community Survey Results technical memorandum is provided in Appendix 2.

The goal of the Whittier Community Survey was to identify mobility needs, typical routes that people take to their destinations, barriers to travel and to using non-automotive forms of transportation, and opportunities to improve travel in the project study area.

The survey was promoted through the City of Whittier's social media channels and digital newsletters and remained open for approximately one month, from the beginning of November 2021 to the beginning of December 2021. During that time, 292 individuals began a survey, and 194 completed and submitted a survey for review by the project team. This section focuses on the results that were submitted.

Survey Overview and Results: The following section summarizes the survey methodology and tools used to collect responses. The tool selected for the community survey was Maptionnaire, a web-based engagement tool that uses a combination of maps and survey questions to gather input from community members and key stakeholders. Through the platform, participants can provide specific feedback that is linked to a particular location, thereby providing accurate and specific information that is very useful to planners and policymakers.

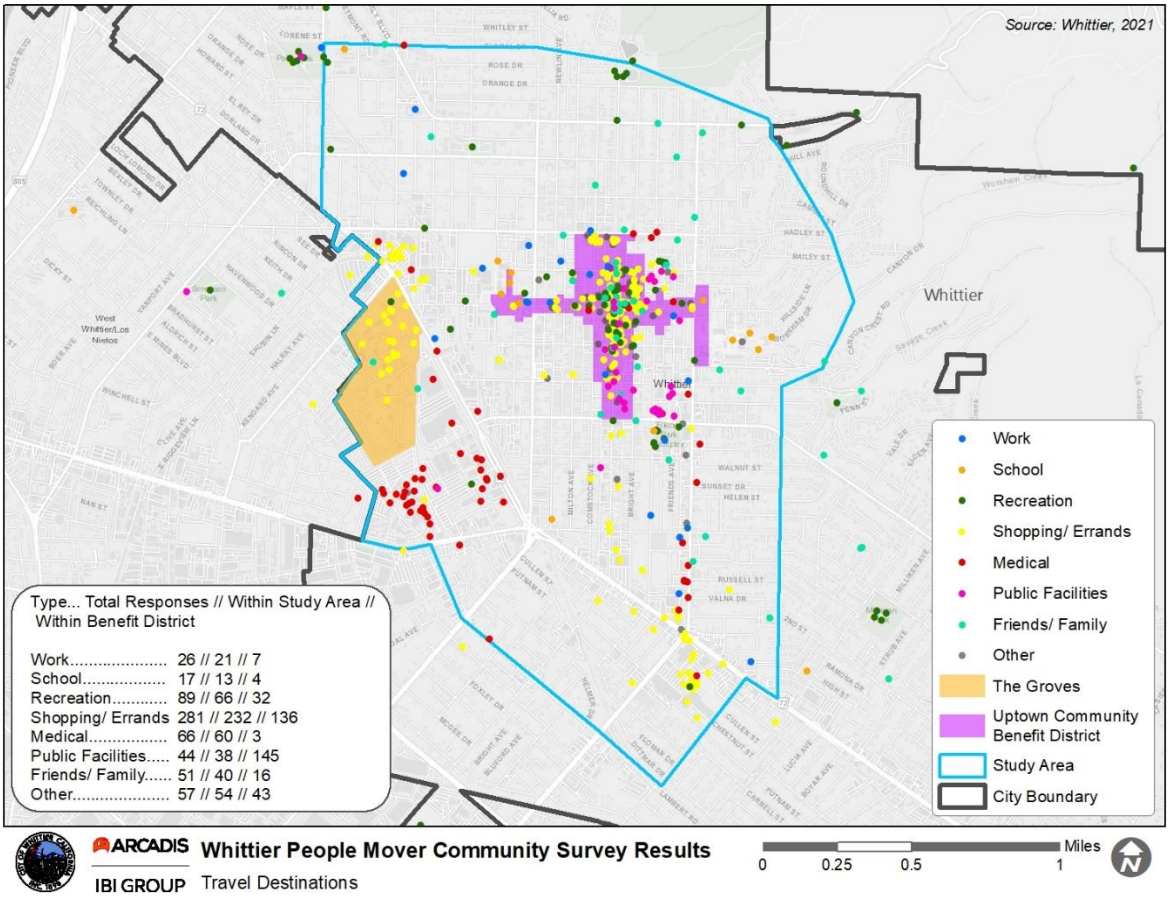
4.1.1 Analysis

1. The vast majority (95%) of respondents have a car of their own or have access to one. Transit dependent individuals may be underrepresented in the survey results.
2. Survey respondents skewed older, with the largest proportion (21%) represented being 35-44 years old. Younger people (under 25) were underrepresented when compared with the City of Whittier demographics as a whole. This means key population groups such as Whittier College students should be targeted in the next engagement activities.

AGE	SURVEY RESPONDENTS	WHITTIER POPULATION
Under 18	0%	24.4%
18-24	0.6%	10.4%

AGE	SURVEY RESPONDENTS	WHITTIER POPULATION
25-34	11.4%	12.1%
35-44	26.1%	15.3%
45-54	20.5%	11.4%
55-64	15.9%	11.9%
65 or over	21.6%	14.5%

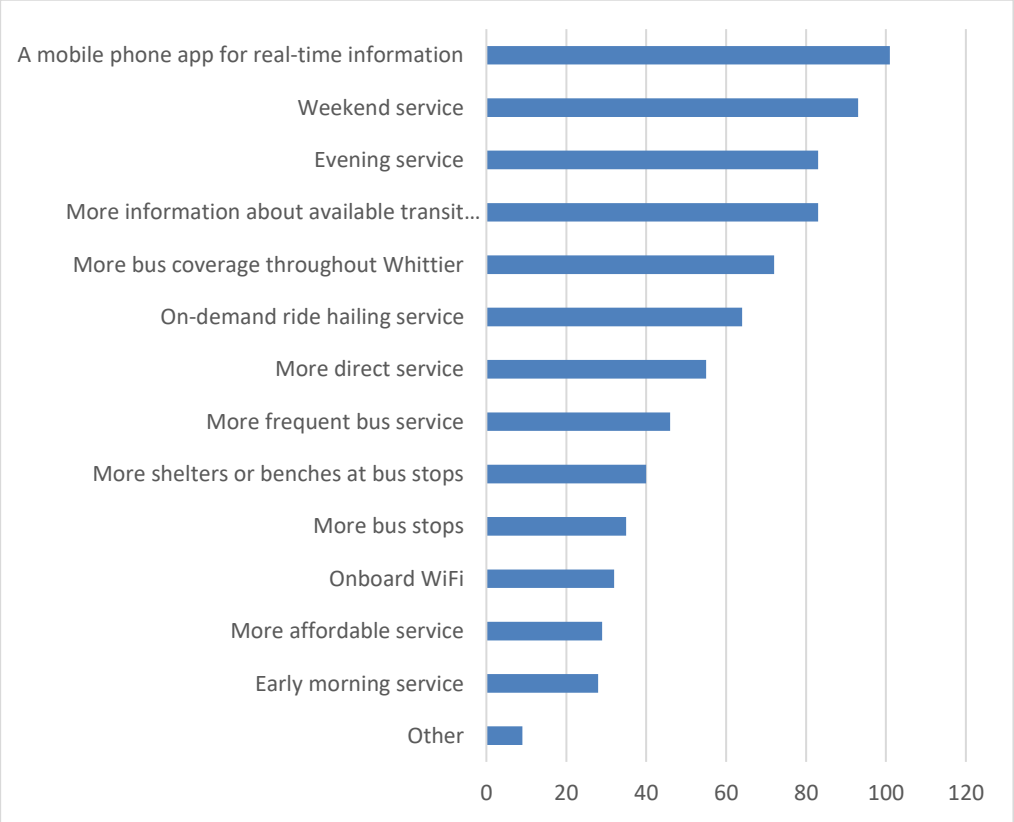
3. Major destinations included The Groves for shopping/errands, Uptown Whittier for a variety of needs, and the PIH Health Whittier Hospital and Kaiser Permanente Medical Center. This confirms the study objectives to explore improved service to these areas, and highlights community interest in the shops and services along Painter Avenue, Greenleaf Avenue, and Whittier Boulevard.



4. Respondents confirmed gaps in service in the Uptown Whittier area, along Whittier Boulevard, and in The Groves. Nearly two-thirds of responses highlighted gaps in the Uptown Community Benefit District, confirming the need for improved service in the area.

5. People have a desire for many different types of mobility improvements—with 770 inputs received.

   Better communication (more information/mobile apps), expanded service hours (weekends, evenings, early mornings), and new connections (through on-demand service or increased bus coverage) were frequently cited.



6. Respondents would like to incorporate alternative modes of travel into their routines.

   The most popular categories for this question were trips that people take frequently or as part of their daily errands, such as getting coffee or going to the post office.

DESTINATION TYPE	QUANTITY
Neighborhood cafe	106
Local service (dry cleaner, post office, etc.)	55
Convenience store	48
Gym or other exercise facility/activity	43
Healthcare provider	22
Local school	18
Grocery/market	9

DESTINATION TYPE	QUANTITY
Restaurants/bars	7
University/job training center	6
Daycare or after school program	4
Park/hiking trail	4
Other shopping	4
Senior center	2

7. Respondents are interested in alternative modes for discretionary travel.

   The popularity of improved weekend and evening service—along with destinations that are outside of the daily commute—indicates that a flexible mode of travel may meet their needs.

4.1.2 Conclusion

Based on the information gathered, survey respondents are open to alternative modes of travel in the Whittier community. They are interested in technology to help assist them but may need more traditional information and outreach as well.

4.2 Stakeholder Consultation and Public Engagement

A series of stakeholder and public outreach events were conducted to inform on study objectives, analysis, identify community needs and concerns, and solicit feedback on mobility alternatives being considered.

Stakeholder meetings were held virtually with city staff responsible for invitees which included representatives from the business, retail, hospitality, health, education, social service, recreation, and development industries.

Similarly, city staff had primary responsibility for broadcasting announcements of public meetings.

The sequence of meetings were as follows:

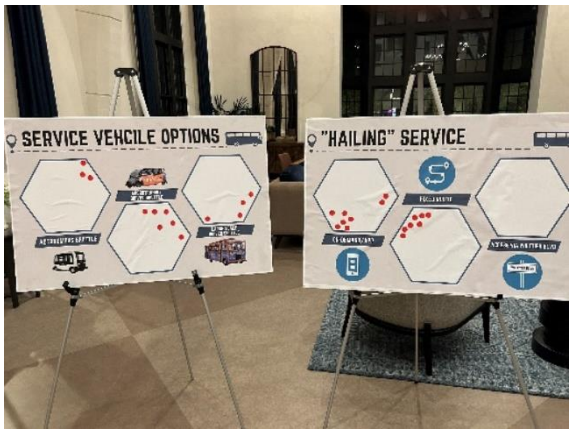
- November 4, 2021 - Stakeholder Meeting (virtual)
- November 10, 2021 - Public Meeting (virtual)
- August 25, 2022 - Joint Session of the Parking & Transportation Commission and the Parks, Recreation and Community Services Commission (in-person)
- October 12, 2022 - Stakeholder Meeting (virtual)
- November 2, 2022 - Public Meeting (in-person)

4.2.1 What We Heard?

There was general consensus that exploring shared mobility solutions in the Uptown Whittier area/corridor was viewed favorably.
Identified needs included:

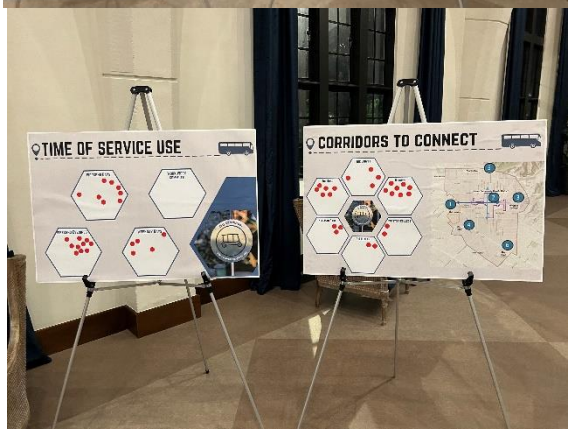
- Address congestion and parking challenges
- Need to reduce the number of single occupancy vehicles by providing alternative mobility options
- Need to provide better options for key market segments including retail workers, students and the elderly and disabled communities.
- Need to provide better connections to Metro and Montebello Bus services.
- Should consider later night service options for hospital workers.
- Concerns with some of the elements of PMoD service including if it used services such as Uber or Lyft, concern with safety and may preclude young people/youth from using the service.
- Several questions arose regarding the level of service (days of week, hours of day), fares, and specific 'routes' that might be served.
- In response to discussion of technology including the prospect of e-hailing, mobile payment, real-time information, etc., the need to address provisions for people who do not have a smart device or the unbanked

The final outreach event was a public meeting held (in-person) on November 2, 2022 at The Commons on the grounds of The Groves. Following a presentation by city staff, a facilitated interactive session had attendees mark their preferences of select service attributes on poster boards.



Attendees echoed many of the comments previously shared including the need for enhanced weekend day and weekend evening mobility services, primarily for discretionary trips. Both autonomous shuttles and microtransit driver shuttles were viewed favorably.

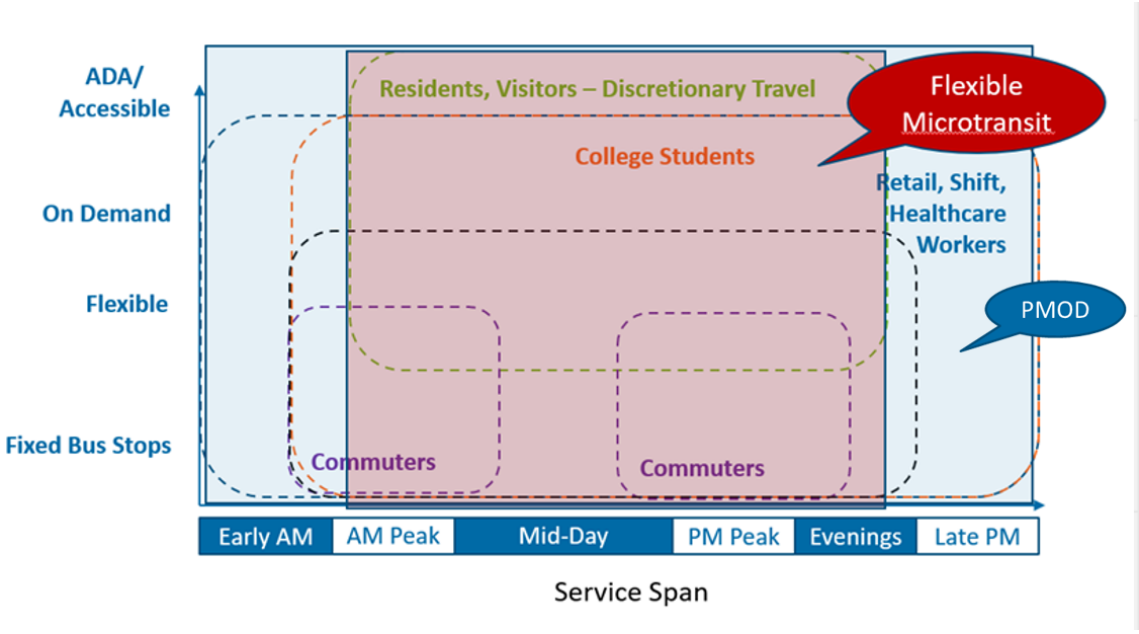
Attendees suggested that Uptown was the primary corridor to serve.

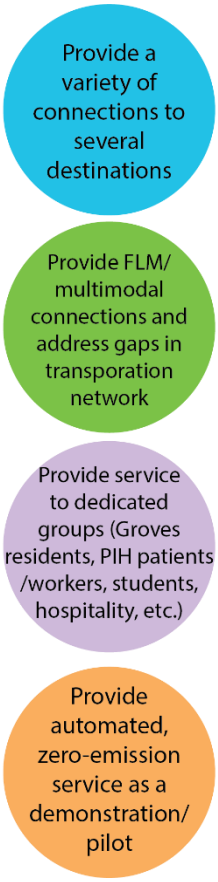


5 Mobility Modes Considered

Informed by the analysis of the study area (Chapter 2), an understanding of the evolving mobility landscape (Chapter 3), and community and stakeholder input (Chapter 4), opportunities for going forward need to reflect a **matching of mobility service types with community needs**. Specifically:

- Provide a variety of connections to several destinations
- Provide first/last mile/multimodal connections and address gaps in the existing transportation/mobility network
- Provide service to a range of market segments including Groves residents, PIH Health patients/workers, Whittier College staff and students, the retail/hospital industry, recreation users of Hellman Park, etc.
- Provide automated zero-emission service as a demonstration project.




Provide a variety of connections to several destinations
Provide FLM/ multimodal connections and address gaps in transporation network
Provide service to dedicated groups (Groves residents, PIH patients /workers, students, hospitality, etc.)
Provide automated, zero-emission service as a demonstration/ pilot

Reflecting the above, this section describes service design alternatives for consideration as mobility options for possible deployment in the study area.

Table 5.1 presents a summary of the service design alternatives and their attributes for each of the following:

1. Personal Mobility on Demand (PMoD)
2. Scheduled Microtransit
3. Flexible Microtransit
4. Vehicle Sharing (compliment to other service alternatives)

Table 5.1: Mobility Modes Considered

Service Alternative		Service Design Attributes					
		Service Description	Vehicle Types	When Can I Use It?	How Do I Use It?	How Much Might It Cost?	Potential Application in Whittier Study Area
	Personal Mobility on Demand (PMoD)	Low-capacity - individuals or small groups. On-demand (next vehicle available) +/or advanced booked	sedans, minivans, taxis, transportation network companies (TNCs) - like Uber, Lyft	Flexible: commuter peak hrs., late night "owl" service, 24/7. **Typically 15 to 30 minute response time.**	Reservations required: app based +/or phone call center	Typically **subsidized** taxi/TNC service. Fare may be $1. or $2.	PIH Health: shift workers - connectivity to higher-order transit.
	Scheduled Microtransit	Moderate capacity - fixed route, set schedule (shuttles, circulators) Like regular transit.	vans, shuttle buses, connected/ autonomous vehicles	Flexible: span & frequency range from defined periods (commuter peaks) to fixed route operating hrs. Primarily as feeders. **Typically would run every 30 to 60 minutes.**	Walk-up service. No booking.	Typically - regular transit fare	Philadelphia Ave. corridor - connectivity The Groves, Uptown, Whittier College
	Flexible Microtransit	Demand Response / On Demand - Moderate capacity, dynamic itinerary.	vans, shuttle buses, connected/ autonomous vehicles	Flexible: span & frequency range from defined periods (commuter peaks) to transit operating hrs. Dynamic in response to demand. **Typically 30 to 60 minute response time.**	Reservations required: app based +/or phone call center	Typically - regular transit fare	Throughout study area: key attractors/generators - The Groves, Uptown, Whittier College, PIH Health, Hellman Park, The Quad, and higher-order transit
	Vehicle Sharing	Bike share, car share, and ride share services - expand reach of fixed-route transit services	Bicycles, electric scooters, sedans	Flexible. **Typically available 24/7.**	Typically walk-up service. May be reservation based.	Typically - market rates.	Key achors: The Groves, Uptown, Whittier College.

5.1 Personal Mobility on Demand (PMoD) Service

5.1.1 Service Description

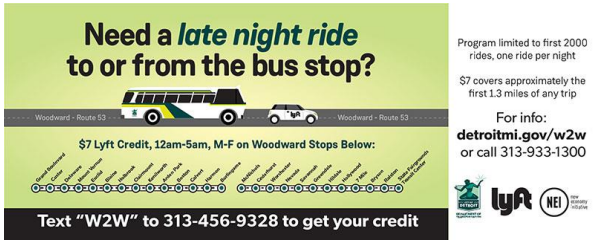
PMoD is a low-capacity service designed for individuals and small groups (up to five persons) traveling together or between various origins and destinations located along a dynamic itinerary formed in response to customer reservations for “next vehicle available” and “advance booking” travel. These services also are referred to as: shared-ride taxi (SRT); general public dial-a-ride; personal demand-response, car service, and paratransit, among others.

5.1.2 Service Design Variations

PMoD is potentially suited to area-wide, zone-based, or corridor coverage operating either as a feeder service to Metro or Montebello transit lines and major employment districts; or dynamic routed and scheduled in response to customer demands.

5.1.3 Industry Examples

Tampa’s *HyperLINK*[2] service is designed to “extend the footprint” of the HART fixed route network with subsidized shared rides to local bus stops within defined zones for a flat $1.00 fare. Additionally, point-to-point service anywhere within the zone is offered for a $3.00 flat fare. HART encourages the use of a branded mobile app developed by Transdev for reservations and fare payment; however, traditional telephone reservations and cash payment of fares are accepted as well.


Need a late night ride
to or from the bus stop?
Woodward - Route 53
Woodward - Route 53
$7 Lyft Credit, 12am-5am, M-F on Woodward Stops Below:
Text “W2W” to 313-456-9328 to get your credit
Program limited to first 2000 rides, one ride per night
$7 covers approximately the first 1.3 miles of any trip
For info:
detroitmi.gov/w2w
or call 313-933-1300

Detroit Department of Transportation (DDOT) partners with Lyft to offer late night FLM service along the outer 5.7 miles of the 9.2-mile Woodward Avenue corridor, one of Detroit’s busiest transit corridors (Line 53) and one of just three lines in the system with owl service. Additionally, the inner 3.5 miles east of Grand Boulevard to the Detroit riverfront is covered by the Q Line (Phase 1 LRT). The *Woodward 2 Work* zone extends northwest from Grand Boulevard to the State Fair Transit Center near Eight-Mile Road. DDOT offers a $7 credit to customers using Lyft for access to and posted bus stops between the hours of midnight and 5 am. Line 53 operates hourly owl service. Non-smartphone users can call Lyft Concierge, and the unbanked can use prepaid gift cards (minimum $25 balance).

[2] As a result of HART’s contractor Transdev, notifying HART of their requirement for twice the rate for the provision of service, HART is reconsideration options for the continuation of this service.

5.2 Microtransit –Scheduled, Flexible and Route Deviation

5.2.1 Service Description

Microtransit provides moderate capacity service designed for individuals traveling between various origins and destinations located along a fixed route operating on set schedules. Microtransit is sometimes referred to as shuttles; circulators, and minibus routes. The term “microtransit” initially described private technology-oriented companies entering the passenger transportation industry; but now include comparable services operated by transit agencies and other not-for-profit entities.

5.2.2 Service Design Variations

Microtransit is potentially suited to area-wide, zone-based, or corridor coverage operating either as a feeder service to higher order transit lines and major employment districts; or dynamic routed and scheduled in response to customer demands. Select examples include:

5.2.3 Level of Service

Span and frequency models range from defined time periods (e.g., commuter peaks, nights), to coverage of full system operating hours as a stand-alone solution to an area’s mobility needs.

5.2.4 Customer Access Options

- **Scheduled:** Operating on a fixed route, fixed-scheduled basis, customers walk-up to access the service, requires no booking. Enhanced customer information, including scheduled and actual vehicle location are available via mobile app, website, and bus stop using beacon technology.
- **Flexible:** Reservations are required for most trips for either “next vehicle available” and “advance booking” basis. As noted earlier, private services emphasize the use of a branded mobile app available in iOS and Android phones and tablets. Public

services also allow traditional telephone reservations to accommodate customers without smart mobile devices.

- **Route Deviated** (hybrid): Operating on a set route with 'some' designed scheduled stop locations supplemented by deviating off the route within a prescribed buffer zone to respond to customer requests.

5.2.5 Financial Model / Fare Structure

Financial models for microtransit services include traditional service contracting with compensation based on revenue hours operated; third-party revenue guarantees; sponsorship; advertising revenues. Most systems avoid onboard fare collection from customers.

5.3 Vehicle Sharing

5.3.1 Service Description

Vehicle sharing includes bike share, e-scooters, and car share services designed to complement other mobility modes considered.

5.3.2 Service Design Variations

Bike Sharing - Short-term bike rental, usually for individual periods of an hour or less over the course of a membership (periods which can range from a single ride, to several days, to an annual membership). Information technology-enabled public bike sharing provides real-time information about the location and demand for bikes at docking stations throughout a community.

In Milwaukee, MCTS partners with local non-profit *Bublr* to locate bike stations along bus routes and co-brand mobile apps to make bike sharing more readily available to bus riders. MCTS markets bike sharing as an added convenience for customers who use the bike racks on MCTS buses, and as a seamless expansion of the reach of the fixed route network. The Bublr app is accessed via an RFID sticker applied to the MCTS M-Card.

In Pittsburgh, the Port Authority of Allegheny County partners with *Healthy Ride*, Pittsburgh's non-profit bike sharing program, to make short-term bike sharing available as a FLM service for PAT customers with a Connect Card. Transit customers with a Connect Card link to a Healthy Ride account at any Healthy Ride kiosk to obtain limited free use of a bike for up to 15 minutes. A charge of $2 per half-hour is charged for rides over 15 minutes. Healthy Ride has 175 stations with 700 bikes in targeted sections of metro Pittsburgh.

The suburban City of Monrovia in eastern Los Angeles County partnered with LimeBike to launch *"GoMonrovia"* offering residents a new bikeshare program as part of a mobility on demand initiative. Over 200 bicycles are available for rent at various locations around the City, including the Metro Gold Line LRT station and the downtown retail area. LimeBike costs $1.00 per 30 minutes of use, or via a monthly membership.

Electric Scooter Sharing is similar to bike sharing, using electric scooters operating in a dockless mode. Service is accessed and paid for using a mobile app. LimeBike provides electric scooters powered by a 250-watt motor with a 20-mile range and 14.8 mph maximum speed. The app also contains a battery monitoring function. LimeBike experience in Austin, TX and San Francisco, CA speaks to the need for regulation to address scooter parking, sidewalk operation, and other issues.

6 Evaluation of Mobility Options

This chapter presents an evaluation framework for the consideration of alternate mobility options (including vehicle types), foundational for *phasing in* or the deployment of an automated (connected vehicle) people mover pilot. The phased in approach acknowledges the city's overarching study object of:

> "The City of Whittier is looking at phasing in a new alternate fueled automated transport system to bring shared ride innovation to the Uptown Whittier area."

Further, informed by an understanding of industry practice with next-generation mobility solutions combined with feedback from the community and key stakeholder constituencies, one key takeaway was the need to present alternate mobility options.

Mobility options considered and their potential application within the study area had been presented in Chapter 5:

- Personal Mobility on Demand (PMoD): PIH Health: shift workers - connectivity to higher-order transit.
- Scheduled Microtransit: Philadelphia Ave. corridor - connectivity The Groves, Uptown, Whittier College
- Flexible Microtransit: Throughout study area: key attractors/generators - The Groves, Uptown, Whittier College, PIH Health, Hellman Park, The Quad, and higher-order transit.

6.1 Service and Ridership Estimation for Mobility Options

A Service and Ridership Estimation Model was developed. A working model developed and provided to the city to assist in planning and deployment of, or modifications to, mobility service scenarios in the future.

The service concepts and assumptions in populating and developing the model formulas are presented below.

Service Design

- Microtransit in a driver operated mode as a precursor for an automated/connected vehicle pilot. Operated by a third-party contractor.
- PMoD service provided by taxi/TNC companies when microtransit operated services are not operating.

Level of Service

- PMoD - Assumes up to 2 vehicles available for the span of service as indicated.
- Microtransit – Assumes 1 vehicle for the span of service as indicated.

Ridership

- The ridership forecasting tool provides for a 'low' and 'high' demand estimate and are based on an assumed utilization ranging from 0.33 to 0.50 (for PMoD) and 0.50 to 0.67 (for microtransit) of available capacity for each span of service hour.

- "Coverage hours" refer to the maximum number of potential revenue service hours that could be deployed if necessary to meet demand for personal mobility service.

The 'working' nature of the model enables the city to modify any of the service characteristics (including fares and/or subsidy rates) to determine net costs.

Service level and ridership estimates are presented in the following tables:

- Table 6.1: Operating Span and Vehicle Requirements
- Table 6.2: Coverage Hours and Ridership Estimates

Table 6.1: Operating Span and Vehicle Requirements

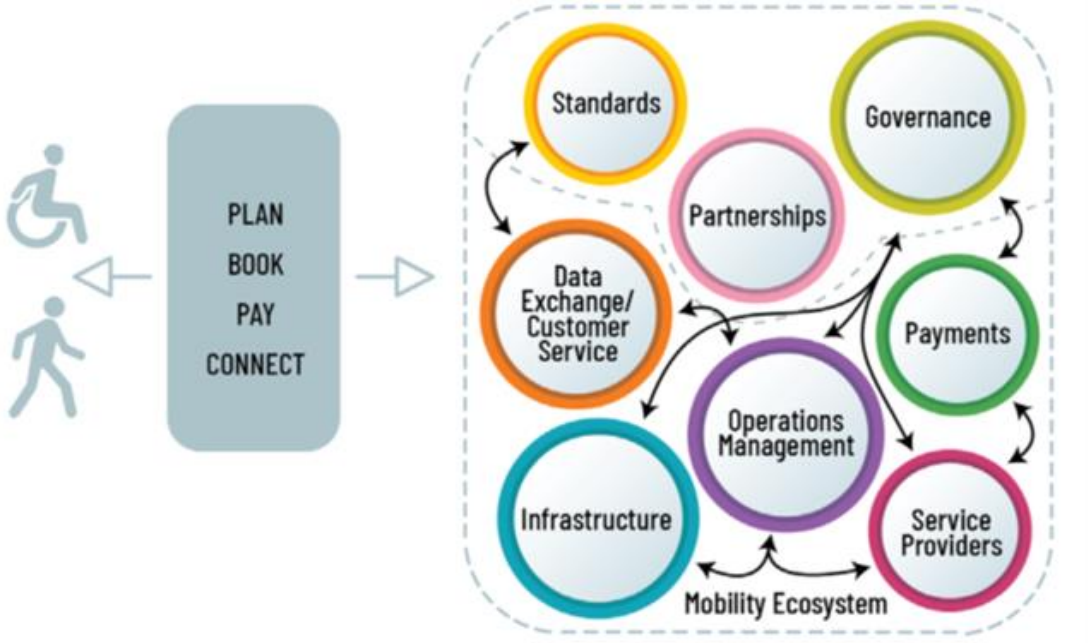
Service Area Size (sq. mi.)	Persons per Square Mile	Service Area Population	Service Mode(s)	Recommended Level of Service - Mon. - Fri.	Recommended Level of Service - Sat., Sun. & holidays	Operating Span Weekday (hours)	Operating Span Saturday (hours)	Operating Span Sat/Sun/Hol (hours)	Weekday Vehicles in Service	Saturday Vehicles in Service	Sat/Sun/Hol Vehicles in Service
1.90	8,421	16,000	Personal Mobility on Demand	5AM - 6AM, 10PM - 12AM	7PM - 12AM	3	0	5	2	0	2
			Fixed Microtransit - driver operated	9AM - 10PM	8AM - 7PM	13	0	11	1	0	1
			Flexible (on-demand) Microtransit	6AM - 10PM	8AM - 7PM	16	0	11	1	0	1
			Fixed Microtransit **Autonomous Vehicle**	9AM - 10PM	8AM - 7PM	13	0	11	1	0	1

Table 6.2: Coverage Hours and Ridership Estimates

Service Mode(s)	Annual Coverage Hours	Capacity per Coverage Hour	Maximum Annual Service Capacity	Low Demand	High Demand	Low Annual Ridership Estimate	High Annual Ridership Estimate
Personal Mobility on Demand	2,650	4	10,600	0.33	0.50	3,498	5,300
Fixed Microtransit - driver operated	3,953	8	31,624	0.50	0.67	15,812	21,188
Flexible (on-demand) Microtransit	5,265	4	21,060	0.50	0.67	10,530	14,110
Fixed Microtransit **Autonomous Vehicle**	3,953	8	31,624	0.50	0.67	15,812	21,188

7 Recommendations - *A Way Forward*

As outlined in the previous chapters, it is important to reflect on the existing mobility ecosystem to determine a preferred mobility future for the Uptown Whittier study area.



7.1 A Recommended Approach

Based on study outcomes reflecting key elements of a mobility ecosystem, the following presents a preferred conceptual plan for advanced mobility services in the Uptown Whittier study area.

1. **Autonomous/Connected Vehicle Pilot:** A concept of operations (presented in Appendix 3) for an *Autonomous/Connected Vehicle Pilot* involves a preliminary framework with an emphasis on developing the systems, processes, and infrastructure for a successful service. Implementation of AV service would be limited to one main thoroughfare within the city – Philadelphia Street providing connectivity between The Groves, Uptown and Whittier College.

2. **Flexible Microtransit and Personal Mobility on Demand (PMoD):** A common concern of community stakeholders was the need for transit service that is more responsive to the needs of transit-dependent persons traveling outside of peak commuting periods and the traditional daytime/early evening service span of many of the existing fixed routes in the study area.

   PMoD provides a mobility option that is more responsive to these community needs and offers higher quality of service during shoulder periods of the day. PMoD can be

summoned on demand versus requiring customers to adhere to a low-frequency fixed-route schedule.

Finally, because PMoD costs are based on service consumed - only accrue on a per-rider basis, low rider volumes can be served much more cost effectively as compared to extending microtransit hours of service.

For these reasons, PMoD is proposed as a supplement to a scheduled microtransit pilot.

The recommended approach is designed to address:

- ✓ **Input from the community** - Community Survey and stakeholder consultation identifying the need for more direct service, enhanced connectivity to major trip destinations, later night service, etc.
- ✓ **Able to address multiple service types including:**
  - First/last mile feeder connections (connectivity to higher order transit);
  - Destination based service including major employers, hospitals, recreational sites, and commercial/retail corridors; and
  - Coverage-oriented transit/mobility in low-density corridors and neighborhoods.
- ✓ **Able to reduce single-occupancy vehicle travel, and hence the reduction of:**
  - Vehicle miles traveled (VMTs)
  - Traffic congestion
  - Greenhouse gas emissions and other air pollutants
  - Energy consumption
  - Demand for on-street parking

The deployment of alternate mobility services may also mitigate some of the congestion and parking challenges anticipated during the construction phase of the Greenleaf Promenade project.

7.2 Implementation Considerations

This section contains a brief discussion of activities to continue to engage community stakeholders to refine the service concept, educate future riders, and develop operational and financial partnerships.

7.2.1 Service Planning

The foregoing analysis is based on service planning assumptions developed by the study team. The assumptions are intended for planning and comparative purposes, but further service planning will be required as a next step to refine operational parameters, develop run-cutting, confirm fleet requirements, and improve operations and maintenance cost forecasts.

It is anticipated that service plan refinement will also involve further engagement of external stakeholders to fine-tune service delivery, adjust service area boundaries or service routing, and finalize hours of service and fare policy.

Further community engagement may also identify business partnership opportunities to support service expansion or to address specific needs. Such partnerships may have an impact on service plan development, fleet requirements, etc.

User comprehension is an important element of the success of new mobility options. This includes where it goes, how to use the service, and what to pay.

7.2.2 Operational and Organizational Readiness

As a new mode, implementation of the mobility alternatives will require organizational/ staffing capacity, procurement of operational capabilities and technology platform, development of policies and standard operating procedures, process re-engineering, and training.

7.2.3 Marketing and Branding

As a new service offering, the city should consider the branding, marketing, and roll-out of the new mobility services.

Several peer agencies have opted to create a unique sub-brand for their mobility services, to create a more visible brand presence and to generate interest around the new service.

User awareness and training is a key aspect of a successful launch. Existing and potential customers must understand what the service is, where it goes, and how to use it. Customers must also be familiarized with the technology tools that support the service, as well as the options available to them if they cannot access those tools.

7.2.4 Technology Procurement and Implementation

As a technology-enabled mode, the new mobility experience is highly dependent on the quality and functionality of technology systems.

The following are technology systems that will be required to support new mobility implementation. It is assumed that the city will be implementing the following supporting technologies either directly or outsourcing to a third-party operator:

- Trip planning/trip discovery application and/or integration with enterprise systems
- Mobility dispatch and operations management system
- Customer reservations/trip booking system
- Customer service/call center reservations support system
- Fare system integration and/or mobile or in-app fare payment options.

It is anticipated that the city will procure the necessary technology systems through a competitive procurement based on system functional requirements developed as part of the procurement documentation.

7.2.5 Operator Procurement: AV, Microtransit and PMoD

Service delivery modes are envisioned as contract-operated services, where the City would issue a competitive procurement to retain a contract operator. The city may also consider an industry request for information or similar discovery process to gauge interest among potential operating partners who currently provide a service of this type.

7.3 Potential Funding Sources

The following presents potential funding sources for the city's consideration in deploying shared mobility services.

Local Return Program: The Proposition A, Proposition C and Measure R and Measure M Local Return programs are four one-half cent sales tax measures approved by Los Angeles County voters to finance improving local public transit, paratransit and related transportation infrastructure.

By ordinance, Metro is responsible for administering the programs and establishing guidelines. The Proposition A tax measure was approved in 1980, the Proposition C tax measure was approved in 1990, Measure R was approved in 2008 and Measure M was approved in 2016. Collection of the taxes began on July 1, 1982; April 1, 1991; July 1, 2009; and July 1, 2017, respectively, while each year, more than $1 billion is generated in local transportation revenue.

As a condition of voter approval, 25 percent of the Proposition A tax revenues, 20 percent of the Proposition C tax revenues, 15 percent of Measure R and 17 percent of Measure M tax revenues are earmarked for the Local Return Programs to be used by cities and the County of Los Angeles in developing and/or improving local public transit, paratransit and related transportation infrastructure.

http://media.metro.net/projects_studies/local_return/images/report_localreturn_2016-06.pdf

Low Carbon Transit Operations Program (LCTOP): LCTOP is one of several programs that are part of the Transit, Affordable Housing, and Sustainable Communities Program established by the California Legislature in 2014 by Senate Bill 862.

The LCTOP was created to provide operating and capital assistance for transit agencies to reduce greenhouse gas emission and improve mobility, with a priority on serving disadvantaged communities. Approved projects in LCTOP will support new or expanded bus or rail services, expand intermodal transit facilities, and may include equipment acquisition, fueling, maintenance and other costs to operate those services or facilities, with each project reducing greenhouse gas emissions.

https://dot.ca.gov/programs/rail-and-mass-transportation/low-carbon-transit-operations-program-lctop

Sustainable Transportation Equity Project (STEP): Includes implementation grants for transportation strategies that include Active Transportation, Fixed-Route Transit, and Shared Mobility. These strategies are meant to encourage mode shift from single-occupancy combustion vehicles, fill transportation gaps, and prioritize first/last mile connections.

https://ww3.arb.ca.gov/msprog/step/proposed-eligible-projects-list-v2.pdf?_ga=2.202874449.1130855256.1578078521-537328793.1426796155

Appendix 1: Automated People Mover - State of Industry / Best Practices Summary

TECHNICAL MEMORANDUM

State of Industry / Best Practices Summary

People Mover Study

Prepared for the City of Whittier
by IBI Group
June 17, 2022

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1 Introduction

1.1 Study Purpose and Background

The City of Whittier is studying the feasibility of providing and automated, on-demand people-mover service that would support mobility needs in and around the Groves at Whittier, a development project undertaken by Brookfield. Other key destinations such as the PIH Health Whittier Hospital, Whittier College and the commercial areas within the Uptown Community Benefit District are also explored as areas that would benefit from this new connection.

The feasibility study is focused on identifying mobility needs and transportation gaps in the Uptown Whittier area to define the parameters of a new people-mover service. It also aims to learn from lessons learned from other jurisdictions who have implemented comparable services.

1.2 Project Objectives

The main objective of this project is to provide for additional mobility options addressing both present and future mobility needs in the Whittier community. It also aims to improve resiliency and quality of life in the study area through a reduction of vehicle miles traveled (VMT), of greenhouse gas emissions (GHG), and of congestion. Finally, the project aims to address key challenges such as parking, and first-last mile connection.

1.3 Best Practices Summary Goal

The autonomous vehicles field is changing rapidly, and yesterday's assumptions or knowledge may become rapidly outdated based on technological or regulatory changes. Since the beginning of this project, projects have been canceled or delayed due to the COVID-19 pandemic, economic uncertainties and supply chain issues, and at least one major supplier of vehicles shut down its operations. The goal of this memorandum is to document the study of recent autonomous vehicle deployments in cities and conditions similar to the City of Whittier, identify best practices and lessons learned from those deployments, and make recommendations based on the most current information available.

In order to accomplish that goal, the technical team reviewed relevant regulatory information for autonomous vehicle deployments, researched existing and planned deployments from around the United States, and conducted interviews with several public agencies who have deployed or are planning autonomous vehicle deployments. The team focused wherever possible on deployments that are happening on public roads, as this is expected to be the primary operating environment expected in the City of Whittier. The information gathered and its key takeaways will then be used to inform the Task 4 Technical Alternatives Evaluation and Task 7 Project Goals and Performance Metrics.

2 Regulatory Framework for Deployment of Autonomous Vehicles

The regulatory framework for APMs and AVs are changing rapidly as policymakers respond to changes in the technology. This section provides an overview of the international, national, state, and local standards applicable to the City of Whittier.

2.1 International/National Standards

Several international standards for autonomous vehicles provide guidance for agencies considering a project within their jurisdiction. The most relevant standards are published by the American Society of Civil Engineers (ASCE) and the International Organization for Standardization (ISO).

ASCE's Automated People Mover Standards (number ANSI/ASCE/T&DI 21-13) establishes minimum requirements necessary to achieve an acceptable level of safety and performance for an automated people mover (APM) system. It includes a wide range of topics such as operating environment, safety requirements, stations and guideways, and would set the foundation for deployment of an APM in the City of Whittier.

ISO's regulation 22737:2021 is titled "Intelligent transport systems — Low-speed automated driving (LSAD) systems for predefined routes" and covers similar topics as the ASCE standards such as performance and system requirements as well as test procedures. It covers level 4 automation within specific operational design domains for systems on predefined routes.

2.2 Federal Regulation

At the federal level, autonomous vehicles are primarily regulated through their designs and safety equipment. As part of the U.S. Department of Transportation, the National Highway Traffic Safety Administration (NHTSA) issued the initial Federal Automated Vehicles Policy (FAVP) to guide safety standards for AVs and adopt the Level 0-5 Society of Automotive Engineers (SAE) definitions of AV types.

Subsequent documents issued by the Federal government have focused on refining the government's policies and broadly speaking, AVs must meet NHTSA standards for safety defined by the Federal Motor Vehicle Safety Standards (FMVSS). However, these standards are based on traditional motor vehicle conventions, such as that the "left" side of a car is the "driver's side," and certain equipment on the vehicle must be oriented relative to that position.

AVs may contain the same safety equipment (such as an airbag deactivation warning light) but could be considered uncompliant if they do not have a driver position around which to orient the equipment. Until these standards are refined and finalized, many operators need to file for exemptions and receive approvals to operate on public roads.

The federal government has left the registration of vehicles, licensing of drivers, and most aspects of vehicle operations to the states to regulate as they see fit.

2.3 State Regulation

In California, the deployment of AVs is primarily regulated by two entities: The Department of Motor Vehicles (DMV) and the California Public Utilities Commission (PUC).

According to the DMV, deployment permits are contingent upon a manufacturer's ability to satisfy the following requirements:

- Identifying the operational design domain of the vehicles, as well as describing any commonly occurring conditions within which the vehicles would not be able to operate.
- Verifying the technology is capable of detecting and responding to roadway situations in compliance with the California Vehicle Code, and a description of how the vehicle meets the definition of an SAE Level 3, 4 or 5 autonomous technology.
- Verifying the vehicles meet FMVSS or have an exemption from the National Highway Traffic Safety Administration. For example, some autonomous vehicles do not have common equipment such as steering wheels or pedals, and therefore do not meet all of the standards of the FMVSS.
- Certifying the manufacturer has conducted test and validation methods and is satisfied that the autonomous vehicles are safe for deployment on California public roads.
- Developing a Law Enforcement Interaction Plan that provides information to law enforcement and other first responders on how to interact with the autonomous vehicles.
- Providing evidence of insurance or a bond equal to $5 million.

California approved the deployment of autonomous vehicle testing without a human in the driver seat in 2018, and as of June 2022 there are seven approved companies: Apollo, Autox, Cruise, Nuro, Waymo, WeRide, and Zoox. Three firms (Cruise, Nuro, and Waymo) have been approved to deploy autonomous vehicles outside of a testing environment.

As the chief agency that regulates charter transportation of passengers in vehicles such as taxis, the PUC must also approve the operation of AV deployments where passenger service is concerned. PUC oversees two programs that were first authorized in May 2018: "Drivered AV Passenger Service" and "Driverless AV Passenger Service." Under the Drivered service, a safety driver is still present in the vehicle, but the Driverless service allows the vehicles to operate only with a remote communication link.

In addition to meeting all DMV requirements, operators must submit a passenger safety plan, file quarterly reports with the PUC, display TCP numbers (similar to taxis and other coach vehicles) and meet insurance and other requirements. Until recently, passengers could not be charged for services offered by AV programs, but recent changes in the regulations have begun to ease that restriction.

In September 2021, the California Department of Motor Vehicles issued permits to Cruise and to Waymo to charge a fee for autonomous services offered to the general public. These services were the first to operate outside of a testing facility and on public roads within specific boundaries, but with a human operator present to take control in the case

of a malfunction. Cruise (a division of General Motors) is operating a fleet of modified Chevrolet Bolts in designated areas of San Francisco between 10pm and 6am at speeds of up to 30 miles per hour. Waymo's fleet of modified Jaguar I-PACE vehicles operate in parts of San Francisco and San Mateo counties at speeds of up to 65 miles per hour. Both types of vehicles can operate in rain and light fog.

In June 2022, California regulators approved Cruise to begin fully operating AVs as taxis in the San Francisco area without a human operator present. The fleet of 30 vehicles is allowed to operate only at night (10pm-6am), partially because the vehicles are unable to drop passengers at the curb, and instead must block a traffic lane while loading/unloading.

2.4 Local Jurisdictions

At the local level, cities and counties may impose additional restrictions or implement additional accommodations for autonomous vehicles. This could be accomplished through special signage informing drivers and pedestrians that AVs are operating nearby, dedicated pick-up and drop-off areas, partnerships with local businesses or key activity centers, or restrictions on where the vehicles are allowed to operate.

2.5 AV Testing Grounds in California

California is home to both closed AV testing facilities and testing areas on public roads. Its two primary controlled-access facilities for AV testing are GoMentum Station in Concord and the California AutoTech Testing and Development Center (CATDC) in Atwater. GoMentum Station is located on the site of a former Navy base and is owned and operated by AAA Northern California, Nevada & Utah. The facility features a variety of roads, tunnels, bridges, traffic control devices, and other equipment used to test AVs. CATDC is located in Atwater, California on a former Air Force base. The facility features an oval track, city course, and multipurpose facilities for scenario simulation, and is connected to multiple OEMs, technology companies, and the Transportation Research Center affiliated with The Ohio State University.

3 Public Perceptions/Concerns to Address

As with any new technology, autonomous vehicles will require a learning curve before they can move from a novelty technology used by the most curious or adventurous travelers to one that is widely accepted and trusted by the public at large. As described in the case studies below and discussions at large, some potential areas of concern that will need to be addressed include the following:

- How will AVs operate in mixed traffic with other vehicles, cyclists, or pedestrians?
- How safe are AVs in the event of a crash, and how does insurance and liability work following a crash?

- How would it feel to ride in an AV without a trained professional such as a transit operator or safety officer present?
- What happens when there is a maintenance issue and the vehicle does not show up?
- What are the potential benefits of this service compared with a more traditional shuttle service?

4 Vehicle Examples

To better inform City of Whittier staff, City Council, key stakeholders, and community members, the team analyzed the capabilities of a range of autonomous and human-operated vehicles offered by different industry providers. Some of the vehicles are custom designs manufactured and operated or sold by the company. Others are standard passenger vehicles manufactured by a legacy auto manufacturer and modified with additional equipment to make them autonomous. A selection of the companies and the vehicles used is presented below.

Autonomous shuttles are vehicles that navigate autonomously at sub-20 to 25 mph speeds along predetermined, learned paths. Because of these characteristics, the shuttle segment is less regulated than the automotive market. Hence, trial deployments are anticipated to ramp up quickly.

Autonomous shuttles may provide an attractive, flexible solution to move people around industrial campuses, city centers or suburban neighborhoods, connecting such areas with main mass transit systems, greatly improving public transportation.

4.1 Human-Operated Shuttles

Due to the rapidly changing nature of the AV industry, the team also reviewed the capabilities of existing human-operated shuttles that could be deployed in the City of Whittier in a phased approach. These shuttles may be less costly and faster to implement than an AV, while helping to familiarize residents, visitors, and key stakeholders with a new type of local service. In Southern California, Anaheim Regional Transit currently operates FRAN (Free Rides Around the Neighborhood) using electric Polaris vehicles that are manufactured nearby and that operate in a defined service area. Farther south, the City of San Diego operates FRED (Free Rides Everywhere Downtown) using similar vehicles, and the City of Oceanside recently began service on a similar pilot program of its own.

Figure 1: Polaris GEM deployment (photo: FRAN)

4.2 Local Motors

Figure 2: Local Motors Olli (photo: VTA)

Local Motors was founded in 2007 as a manufacturer of crowd-sourced vehicles that used 3D printing for components of its early designs. It transitioned into the automobile space in 2016 with the release of Olli, a small shuttle designed to operate at speeds of up to 30 mph. Olli was deployed in approximately two dozen locations over the past several years, and a new version of the vehicle designed for ADA compliance was expected to operate in Palo Alto, CA (see case study below) before the company went out of business in January, 2022.

4.3 GreenPower

Figure 3: AV Star (photo: GreenPower)

GreenPower is a manufacturer of purpose-built (rather than converted) electric vehicles focused on heavy duty applications, such as cargo delivery, public transit, and school buses. Based on its EV Star platform, the company claims that the AV Star is the first zero-missions, Buy America, ADA compliant vehicle that is fully autonomous. It is capable of operating at speeds appropriate for arterial roads (40-45mph) with up to a capacity of 21 passengers. The first AV Star is currently undergoing testing on public roads in Youngstown, OH, with expected deployment in San Jose, CA at a later date.

4.4 Waymo

Figure 4: Waymo Chrysler Pacifica (photo: Valley Metro)

A subsidiary of Alphabet, the parent company of Google, Waymo has been testing its AV technology for several years, primarily using converted passenger vehicles such as Chrysler Pacifica minivans. Waymo's vehicles are capable of operating on major streets, and the company has been permitted to provide ride-hailing/taxi-like service in both Arizona and California. Its current deployment in California uses converted Jaguar I-PACE SUVs.

4.5 May Mobility

With funding from Toyota, BMW, Bridgestone, and a number of venture capital funds, May Mobility has incorporated its AV technology into Lexus SUVs and Toyota minivans. To provide ADA service, the company has also converted small shuttles (similar in appearance to a large golf cart) that some jurisdictions are using for local shuttle service with a human operator. Their converted SUVS/minivans are capable of operating on major streets, while the smaller shuttles are limited to 25-30mph.

Figure 5: May Mobility Lexus RX

4.6 EasyMile

Like Local Motors, EasyMile is a manufacturer of small purpose-built electric AVs that have been deployed around the world, often in more controlled areas or private sites such as business parks, airports, factories, and universities. Based in France, many of the company's deployments have been in Europe and Asia, but the company has also operated in Salt Lake City, UT and Boulder, CO (see case study below). Its EZ10 is capable of carrying up to twelve passengers, has a built-in automated electric ramp, and travels at speeds up to 25 mph.

Figure 6: EasyMile EZ 10 (photo: Colorado Smart Cities Coalition)

4.7 Navya

The Navya Autonom Shuttle (previously known as Navya ARMA) is an autonomous, low-floor, battery-electric mini-bus built by French firm Navya.

Navya Autonom Shuttles have been deployed in cities around the world, with a notable presence in Europe, North America and Australia.

Figure 7: Navya (photo: Las Vegas Downtown Circulator)

A Navya driverless shuttle operated in downtown Las Vegas. The City of Las Vegas and Keolis initially partnered on a short term deployment in January 2017, which was then followed by a year-long pilot sponsored by AAA of Northern California, Nevada & Utah for a 0.6 mile loop involving eight intersections and connected infrastructure.

5 Deployment Cost Estimates

The costs of automated low speed shuttle demonstrations have varied depending on the number of shuttles used, vehicle miles travelled, length of lease, and if an operator on board was required.

It is important to note the uncertainty of true cost estimates as some of the vendors in the AV space are underwritten by venture capitalists that may be willing to take a long view on profitability.

6 Case Studies

To better inform the Whittier Shared People Mover study by collecting best practices and lessons learned, the technical team completed four case studies of AVE deployments that are either recently-completed, currently operating, or being planned for near-term implementation.

6.1 Case Studies Considered

The technical team reviewed existing documentation of autonomous vehicle deployments around the United States and updated it based on publicly available information found on the websites of public agencies and news sources. A summary of the AV deployments information compiled through the web is listed in Appendix A at the end of this report.

6.2 Case Studies Overview

Following the initial case review, the team identified the projects most comparable to the Whittier case and reached out to agencies, prioritizing projects located in California (and therefore subject to a similar regulatory environment), as well as those operating on public roads or with similar operating environments to Whittier. The following four case studies were completed thanks to the willing participation of representatives from the Santa Clara Valley Transportation Authority, Valley Metro, City of Arlington (TX), and Colorado Smart Cities Alliance.

6.2.1 Palo Alto, CA

Key Facts
- Projects funded by FTA with local match
- Two projects in development
- Vehicles in operations: TBD
- Status: Planning

Located in the heart of Silicon Valley, the Santa Clara Valley Transportation Authority (VTA) serves approximately 120,000 riders per day with three light rail and 70 bus lines. The agency's Board of Directors are very focused on innovation, and its autonomous vehicle pilot programs were championed internally by the agency's recently-retired Chief Innovation Officer. The agency is developing two autonomous vehicle pilot programs aimed at serving the Palo Alto Veterans Affairs (VA) Hospital, a major activity center with multiple buildings across a large campus, and a significant number of transit-dependent or non-ambulatory visitors. The hospital is located roughly equidistant from two Bay Area Rapid Transit (BART) heavy rail stations.

The first pilot project was expected to operate within the VA Hospital campus, aiming to connect patients with their appointments and medical services internally. VTA planned to use small Olli vehicles built by Local Motors, operating on a fixed route on private roads within the campus at a maximum speed of 25 mph. However, with Local Motors going out of business in January 2022, it is unclear if the pilot will continue with another vehicle or if the project will be modified in some other way. Funding came from a local match and FTA funds through an IDEA Grant administered by the Metropolitan Transportation Commission (MTC), the Metropolitan Planning Organization (MPO) for the San Francisco Bay Area.

The second pilot project will connect the Palo Alto VA with Stanford University and the Palo Alto BART station, and is expected to begin operations in 2023. It will use the larger, higher-capacity AV Star vehicle manufactured by GreenPower Motor Company that is capable of higher speeds on larger arterial roads. The vehicle will first be deployed in Youngstown, Ohio, with the intent of applying any additional lessons learned to the project in Palo Alto. It is also being paid for with a local match combined with FTA funding from the Accelerating Innovative Mobility (AIM) program. The project will be free to riders in its first year, with fares collected after that.

In addition to the information provided above, VTA staff identified additional recommendations to plan for deployment of AVs, listed below.

Key takeaways:

- Define what success looks like early on. AVs may not provide a benefit beyond what can already be accomplished by a traditional vehicle and operator.
- During early assessment of vehicles, VTA found that AV research and development is focused on travel and not necessarily on meeting the needs of all riders, such as people with disabilities. Not every vehicle is capable of addressing many of the ADA needs of paratransit riders, such as whether or not to deploy a ramp, and these limitations need to be considered during vehicle selection.
- The Olli vehicle was selected in part for its built-in ADA accommodations, but it is unclear whether the pilot will continue with another vehicle or be modified in some way.
- Strong partnerships are important to project success. The Palo Alto VA is a highly valuable partner on the project, helped define the use case and project motivation, and facilitated outreach to potential riders.
- Managing expectations is also important. Riders and key stakeholders need to know what to expect from the service, as well as what will happen if something unexpected occurs, such as a maintenance issue.
- A long-term question for VTA is whether or not these systems can scale to better serve the needs of riders.

6.2.2 Chandler, AZ

Key Facts
- Project funded by FTA but operated primarily by Waymo
- Pilot operated 2019-2020
- Vehicles in operation: 50-75
- Status: Complete

Chandler is one of the many large cities that make up the greater Phoenix metropolitan area. It is served by Valley Metro, the region's primary transit operator. Valley Metro's AV pilot project was developed as a retooling of a previous Mobility on Demand (MOD) Sandbox Program grant from FTA. Valley Metro partnered with Waymo, whose fleet of autonomous vehicles (modified Chrysler minivans) were already operating in a defined service area around the company's facility in Chandler, and which are capable of moving at the relatively high speeds (45 mph) found on arterial streets in the Phoenix area. Researchers at Arizona State University also provided program management support to survey riders and collect data about their experiences.

From a regulatory standpoint, the state of Arizona is operating under an executive order from the Governor's office that reduces barriers to AV operations in the state. The City of Chandler is also operating its own pilot program with Waymo and has developed special pick-up and drop-off zones in some locations. Because Waymo was already operating in the selected service area and other coordinating departments such as police and fire were familiar with the service, partnering with them streamlined implementation of the program for the agency.

The program began with exclusive access to Valley Metro employees who lived in the service area but was quickly expanded to other paratransit riders. Service was focused on door-to-door travel similar to the agency's existing paratransit RideChoice program, but all riders selected for the pilot are ambulatory due to limitations of the Waymo vehicles. The existing service area also comes close to but does not connect to Valley Metro's light rail service. Fares charged for the service are the same as for the existing RideChoice program; Valley Metro subsidizes the cost, which is much lower than the agency's Dial-a-Ride service.

Both local officials and participants in the program were very positive about it, and representatives of other jurisdictions expressed interest to Valley Metro in deploying a similar service of their own. In addition to the information provided above, Valley Metro staff identified additional recommendations to plan for deployment of AVs, listed below.

Key takeaways:

- Data sharing agreements with private firms can be complicated, as the companies are focused on protecting their intellectual property and public agencies are subject to public information requests.
- Working with ASU allowed for greater confidentiality between the project partners, since the research conducted by the university is not subject to the same freedom of information act requests. The university conducted extensive surveys of riders and paid them for their participation.
- Fully autonomous AV service cannot provide service to non-ambulatory passengers as a result of the vehicles used.
- Although the service is on-demand and does not operate on a fixed route, all roads and locations within the service area have to be mapped and incorporated into the mobility platform.
- Many of the smaller AVs available are unsuitable for the project area's public roads, as they do not travel at a high enough speed to flow with traffic.
- Arizona's regulatory environment is less restrictive than California's, and the project was dependent upon the existing operations of Waymo.

6.2.3 Arlington, TX

Key Facts
- Funded by FTA IMI Program
- Service began March 2021
- Status: In operation
- Vehicles in operations: 6

Located in northern Texas between the cities of Fort Worth and Dallas, Arlington is home to approximately 400,000 residents along with the University of Texas at Arlington (UTA) campus, a major General Motors manufacturing plant, and many entertainment destinations such as theme parks and professional sports stadiums.

The City of Arlington has pursued several innovative transportation programs over recent years, with the current program representing the third pilot so far. Its focus is to expand on the work and lessons learned in previous programs, to continue testing in a real-world environment on public roads, to identify what works and does not work with current vehicles, to educate the public on AVs, and to serve the travel needs of UTA's students. The program is operated by May Mobility and uses a fleet of five vehicles, four of which are Lexus SUVs and the other one a Polaris GEM converted for ADA use, providing wheelchair-only service. The pilot is funded by an FTA Integrated Mobility Innovation program grant.

Existing rideshare service in the city's 99 square miles is provided by Via Transportation. Within that area, the City identified a one square mile service area that covered the UTA campus and the main downtown core and worked with May Mobility to analyze routes and stops and incorporate their service into Via's platform. When located in the AV service area, riders request a ride through the Via application just as they would book another rideshare option. UTA students make up the majority of riders and their trips are free; the general public would generally pay $3-5 for a ride within the AV service area, depending on distance. The service provided approximately 200 rides per day at its peak in November 2021 and has received high marks for safety and comfort.

In addition to the information provided above, City of Arlington staff identified additional recommendations to plan for deployment of AVs, listed below.

<u>Key takeaways:</u>

- Insurance provisions for contracts required extra coordination between the City's attorneys, Via, and May Mobility as a subconsultant.
- Previous pilot projects over several years helped socialize the technology with the public.
- Perception of the wheelchair-accessible vehicle is lower than that of the general vehicle; agencies should look for vehicles with comparable features for all riders.
- Identifying roles and responsibilities is very important, especially within service providers if the project is not a turnkey solution. Agency staff may be juggling many other priorities that are not related to the project, and it is very helpful to have a point person in the local jurisdiction that can help coordinate between departments.
- A well-defined user case and service area are equally important to managing expectations and providing a quality experience for riders.

6.2.4 Golden, CO

Key Facts
- Funded through coalition of stakeholders
- Pilot project ran September-December 2021
- Status: Complete
- Vehicles in operations: 9

Golden is a small city of approximately 20,000 residents located approximately 10 miles west of downtown Denver. Its recent AV deployment is being coordinated by the Colorado Smart Cities Alliance, a statewide nonprofit organization that promotes innovative solutions to urban challenges. The Alliance includes government members (such as cities and departments of transportation), private companies, and a range of universities, research centers, and other non-profits. AVs in Colorado operate under regulations established by a statewide task force that is encouraging of deployments, but special exemptions with the Department of Motor Vehicles for the vehicles are needed.

As part of its work, the Alliance is developing a CityForward Playbook to help with AV deployment, and has been working to identify locations in which to test and learn. Golden was selected because of its unique location where the Colorado School of Mines is located adjacent to a compact, walkable downtown area in need of additional transportation options. The team partnered with EasyMile to deploy a fleet of nine EZ10 vehicles (branded as the “Mines Rover”), which carry up to 12 passengers and operate at speeds up to 25 mph.

The team created three fixed routes to connect key destinations in and adjacent to the campus (such as student housing, parking lots, and athletics fields) within the downtown Golden area. For ease of deployment, routes were selected where the vehicles would not encounter traffic signals. The service was free to riders—most of whom are students—and operates from 7:30am-4:30pm Monday-Friday. The pilot project ran for four months between September and December 2021.

In addition to the information provided above, Colorado Smart Cities Alliance staff identified additional recommendations to plan for deployment of AVs, listed below.

<u>Key takeaways:</u>

- Cities may have an idea of what they want to connect, but until they begin detailed site assessments with a specific company, it is difficult to predict everything that is needed to operate.
- Constant collaboration between the vendors, the City, the University, and the Alliance has been required for success. Each entity has also contributed financially to the project.
- Location of a charging/maintenance facility is crucial. If it is not located close to the route, then range will be compromised.
- A rigid procurement process could be a major risk to AV implementation, as there could be changes in equipment and vendors needed.
- Agencies need a contingency plan for when vehicles have maintenance issues and need to be taken out of service.

- It is important to set expectations and educate the public about the vehicles' capabilities. Ridership dropped in the fall after students moved in and became more familiar with the speeds and capabilities of the vehicles.
- Reliability is crucial to maintaining ridership and to keep people from viewing the service as a novelty.
- Hiring students to work as the onboard ambassadors for the shuttles was particularly successful.

7 Key Takeaways for Whittier

The case studies exercise revealed many key takeaways for potential deployment of an autonomous vehicle/shared people mover concept in the City of Whittier. They are organized into three primary categories and detailed below.

Technical Takeaways are related to the vehicles and the environments in which they operate. These include:

- It is important to select a vehicle that can meet the needs of its operating environment. Small driverless shuttles like the Olli that operate at lower speeds would not be a good fit for Whittier Boulevard, but may be suitable for smaller neighborhood streets in the city.
- Operation of more advanced vehicles such as those used in Chandler, AZ or Arlington, TX require an extensive data collection and mapping effort to safely operate at higher speeds in a larger area. This would require an advanced partnership with a private operator.
- One of the principal limitations of AV deployments is the location of a maintenance facility. This can have major implications for the range and service area.

Governance Takeaways are related to the planning, implementation, and funding of the potential project. These include:

- Implementation of an AV program can be expensive. The City of Whittier may be able to add or improve traditional mobility options at lower cost. Additional funding through grants might be possible but may not cover the entire cost of the AV program.
- The City should evaluate its own procurement processes to understand if any restrictions or hurdles might complicate the purchasing/contracting process with potential vendors.
- Even with "turnkey" AV solutions that are mostly planned and operated by a private firm, the workload for cities to implement an AV program can be resource-intensive. The City should have a dedicated project manager who has sufficient time and capacity to oversee the program, as well as strong relationships with partner agencies and departments.
- The City of Whittier may need to implement an AV regulation to clearly define roles and responsibilities for how the system would operate.

- Insurance and liability for AV systems are complicated issues. The City's legal department should be involved early in the process.

Acceptability and Social Perceptions Takeaways are related to expectations and community engagement/buy-in. These include:

- Should the City pursue an automated people mover concept, it would be vitally important to properly set expectations about what the service can do, what it cannot do, and what happens in response to a maintenance issue, crash, or other unexpected event.
- A crucial component of buy-in is identifying a community mobility need, making a clear case for how AVs can address the need, and engaging with the public early and often about the project to understand any concerns.
- Safety and reliability are of utmost importance to potential riders and should be considered frequently during the engagement process.

8 Conclusion and Next Steps

The best practices and key takeaways from this report will help the technical team to evaluate potential APM concepts within Whittier's specific context and will be incorporated into the Technical Alternatives Evaluation in Task 4 and the Project Goals and Performance Metrics in Task 7. This will help ensure that the final recommendations for the project reflect the most recent information available, and that the City of Whittier can evaluate potential APM solutions with a clear understanding of how useful they may be to residents and stakeholders.

Appendix A: AV Projects Matrix

Table 1: Autonomous Vehicles Projects Matrix

LOCATION	PROJECT TITLE / LEAD AGENCY	PARTNERS	PUBLIC ROADS	DESCRIPTION	TIMEFRAME	STATUS
Chandler, AZ	Valley Metro[1]	Waymo	Yes	Provided service to users of the RideChoice program via Waymo vehicles. The initial phase of testing provided rides Valley Metro employees. On-road testing was completed in summer 2020.	Launched September 2019, completed March 2020	Complete
Dublin, CA	LAVTA First/Last Mile Shuttle to BART Station	EasyMile Transdev	Yes	First/Last Mile shuttle to East Dublin/Pleasanton BART station on mixed-traffic roads.	Launched fall 2020	Operational
Fairfield	Paradise Valley Estates Shuttle	Optimus Ride	No	Optimus Ride shuttle in a continuing care retirement community campus.	Launched June 2020 as a meal delivery service due to COVID	Complete
Miramar, CA	MCAS Miramar Modern Installation Mobility	Local Motors Qualcomm US Ignite	No	Active testing and planning for additional deployment on the military base and in surrounding areas.	Launched February 2019	Complete

[1] Shaded projects indicate that their lead agencies were interviewed for this report.

LOCATION	PROJECT TITLE / LEAD AGENCY	PARTNERS	PUBLIC ROADS	DESCRIPTION	TIMEFRAME	STATUS
Mountain View, CA	VTA North Bayshore Transit Connection	Google Lea+Elliott Apex Strategies	No	Connection between VTA light rail station and North Bayshore (a.k.a. Googleplex, a business park including Microsoft and other employers).	Feasibility study conducted in April 2018, no news on launch	Complete
Sacramento, CA	Sacramento State University AV Shuttle	Local Motors	No	2 LSAV shuttles between two campus buildings on cmapus roadways.	Launched March 2019, completed May 2019	Complete
San Francisco, CA	Treasure Island LSAV Taxi	Unknown	No	San Francisco County Transportation Authority LSAV taxi project on Treasure Island.	Was expected to be launched late 2019, no news since 2018	Planning
San Jose, CA	The Villages / Voyage On-Demand LSAV	Voyage	No	Retirement community on-demand service. Phase 1 completed. Phase 2 testing.	Launched October 2017	Complete
San Ramon, CA	Bishop Ranch / GoMentum LSAV Testing	EasyMile GoMentum Station AAA NorCal Local Motors First Transit	Yes	Phase 1: Business park circulator to test signal prioritization/performance. Phase 2: First/last mile service in mixed traffic.	Launched March 2017, testing on public roadways on hold	Complete
Santa Clara, CA	Santa Clara Valley Transportation Authority (VTA)	Local Motors / Green Power	No	Developing accessibility features for an automated Local Motors Olli shuttle within VA Palo Alto Health Care campus. Second pilot	Not launched due to closure of Local	Unknown

LOCATION	PROJECT TITLE / LEAD AGENCY	PARTNERS	PUBLIC ROADS	DESCRIPTION	TIMEFRAME	STATUS
				would connect campus with BART.	Motors; Second one Q3-4 of 2023	
Golden, CO	Colorado School of Mines AV Shuttle	EasyMile Stantec Siemens Colorado Smart Cities Alliance	Yes	16 LSAV shuttles running 3 routes between 1 and 4 miles long around the Colorado School of Mines campus and the surrounding area.	Launched August 2021	Operational
Washington, D.C.	The Yards Connector	Optimus Ride	Yes	Point-to-point shuttle with 2 stops within Brookfield mixed-use development and 5 stops within nearby neighbourhoods.	Launched February 2021	Operational
Fishers, IN	Nickel Plate District AV Shuttle	IndyGo Toyota Mobility Foundation May Mobility Indiana Economic Development Corporation Energy Systems Network	Yes	5 Lexus (not accessible) and 1 Polaris GEM (accessible) providing free rides around the City of Fishers Nickel Plate District.	Launching December 2021, ending June 2022	Complete
Indianapolis, IN	Red Line-IUPUI AV Shuttle	IndyGo Toyota Mobility Foundation	Yes	5 Lexus (not accessible) and 1 Polaris GEM (accessible) providing free rides between the Red Line Vermont BRT	Launched June 2021, completed	Planning

LOCATION	PROJECT TITLE / LEAD AGENCY	PARTNERS	PUBLIC ROADS	DESCRIPTION	TIMEFRAME	STATUS
		May Mobility Indiana Economic Development Corporation Energy Systems Network		Station and the Indiana University–Purdue University Indianapolis campus in downtown Indianapolis.	November 2021	
Grand Rapids, MI	AVGR Shuttle Service	May Mobility Gentex	Yes	Used 4 non-accessible shuttles and 1 accessible shuttle within the City of Grand Rapids on a 3.2-mile route, then converted to an on-demand service within the core	Launched July 2019 as fixed route, changed to on-demand service July 2021	Operational
Las Vegas, NV	Las Vegas Keolis-AAA Shuttle	Keolis Navya AAA	Yes	Downtown LSAV circulator near Fremont Street tourist area, on street in mixed traffic.	Launched November 2017, completed October 2018	Complete
Arlington, TX	Downtown/UTA AV Shuttle	May Mobility	Yes	Integrating automated vehicles from May Mobility into its existing on-demand system operated with the Via ride-sharing service. The service includes a wheelchair accessible vehicle and allows University of Texas at	Launched March 2021	Operational

LOCATION	PROJECT TITLE / LEAD AGENCY	PARTNERS	PUBLIC ROADS	DESCRIPTION	TIMEFRAME	STATUS
				Arlington students to ride fare free.		
Various Locations	Utah Automated Shuttle Pilot Project		No	Series of 3- to 5-week LSAV shuttle pilots around the state to connect to fixed-route transit in a variety of operating environments and locations.	Launched April 2019, completed September 2020	Complete

Appendix 2: Community Survey – Summary Report

TECHNICAL MEMORANDUM

Online Community Survey Results

People Mover Study

Prepared for the City of Whittier
by IBI Group
January 4, 2022

Document Control Page

CLIENT:	the City of Whittier
PROJECT NAME:	People Mover Project
REPORT TITLE:	Online Community Survey Results
IBI REFERENCE:	136144
VERSION:	
DIGITAL MASTER:	
ORIGINATOR:	Eric Tunell
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1 Introduction

1.1 Study Purpose and Background

The genesis of this project dates to March 2019, when Brookfield Development sought to amend their Development Agreement for their project, The Groves, at the former Nelles property in Whittier. As part of the amended agreement, Brookfield agreed to help fund a study of potential routes for a small-scale circular transit route that would connect The Groves Development, PIH Health Hospital, Whittier College, Uptown, and Hellman Park. Brookfield also arranged a presentation to City Council on their partnership with Optimus Ride, a provider of shared autonomous vehicles.

As the first phases of The Groves residential and commercial developments are complete, City Council has adopted as one of its objectives for this fiscal year the study of potential routes for a “people mover” circular – the phasing in of a new alternate fueled automated transport system to bring shared ride innovation to the Uptown Whittier area.

In short, the City of Whittier is considering opportunities to enhance travel connectivity within a 1-2 mile radius around the Uptown Whittier/5 Points area between the new residential and commercial community known as the Groves in Whittier, and key activity centers in the Uptown Whittier area including Hellman Park, PIH Health Hospital, and Whittier College with onward connectivity transit options to the shopping malls located at the Quad and the Whittwood.

1.2 Project Objectives

Providing greater mobility access for residents to existing and emerging commercial areas, educational and medical facilities, and employments sites is a priority for the city’s leadership. To meet the accessibility needs of the residents, the city is interested in exploring the potential for an electric automated people mover to operate throughout the Uptown Whittier area connecting the Groves in Whittier, Whittier Marketplace, Hellman Park, Uptown Whittier, Whittier College and PIH Health Hospital (site for potential future Metro light rail station).

In addition to opportunities to provide additional mobility options, a Whittier People Mover service may: reduce the use of single occupancy vehicles; reduce vehicle miles traveled (VMTs); reduce greenhouse gas (GHG) emissions; and address congestion and parking challenges.

Key project objectives include:

- Definition of a study area and identification of key activity centers with data collection and analysis to support the selected area and centers.
- Profile existing transit conditions in the study area.
- Review planned future conditions for public transportation alternatives, to guide the definition of mobility alternatives in the study area.
- Review of study area's socio-economic data, demographics, and employment, as well as existing land use patterns, and planned and approved developments.
- Review of how the People Mover project facilitates intermodal movement of people and connectivity to local bus routes, bike trails, local shopping malls, and light rail service.

- Outline ridership data for a People Mover service consistent with the California Air Resources Air Board's California Climate Investments (CCI) quantification for Affordable Housing and Sustainable Communities (AHSC) Projects.

The project work plan encapsulates:

- **Investigation** – **Review and understand** the unique conditions of the diverse and varied constituencies of the city's study area including The Groves and Uptown Area.
- **Innovation** – **identify** and **analyze mobility solutions**, vet these with the community.
- **Solutions** – develop an **action** and **implementation plan**, describing proposed deployment plan and its benefits.

1.3 Survey Goal

The goal of the Whittier Community Survey was to identify mobility needs, typical routes that people take to their destinations, barriers to travel and to using non-automotive forms of transportation, and opportunities to improve travel in the project study area.

The survey was promoted through the City of Whittier's social media channels and digital newsletters and remained open for approximately one month, from the beginning of November 2021 to the beginning of December 2021. During that time, 292 individuals began a survey, and 194 completed and submitted a survey for review by the project team. This report focuses on the results that were submitted.

.

2 Survey Overview and Results

The following section summarizes the survey methodology and tools used to collect responses. The tool selected for the community survey was Maptionnaire, a web-based engagement tool that uses a combination of maps and survey questions to gather input from community members and key stakeholders. Through the platform, participants can provide specific feedback that is linked to a particular location, thereby providing accurate and specific information that is very useful to planners and policymakers. The technical team created a map that included layers to identify key boundaries considered by this study, including the City of Whittier, the Uptown Community Benefit District, and The Groves development. The overview map is illustrated in Figure 1 below.

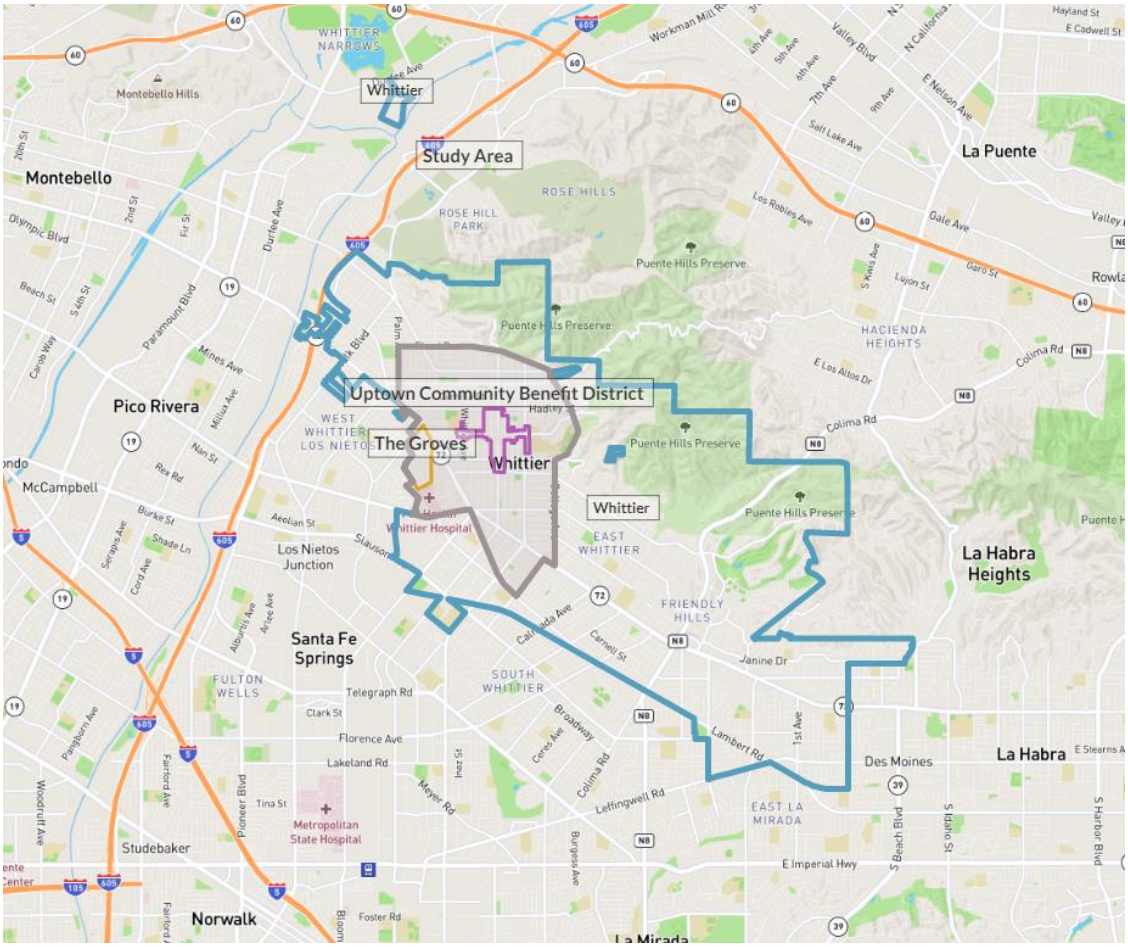


Figure 1: Community Survey Overview Map

2.1 Demographic Questions

The survey included two primary components: a series of demographic questions designed to assess who the survey reached, and a mapping exercise that asked participants to identify locations for mobility needs and improvements. The results of the demographic survey questions are listed below.

What is your age?

AGE	QUANTITY	PERCENTAGE
Under 18	0	0%
18-24	1	1%
25-34	20	11%
35-44	46	26%
45-54	36	20%
55-64	28	16%
65 or over	38	22%
Would rather not say	7	4%

What is your gender?

GENDER	QUANTITY	PERCENTAGE
Female	129	70%
Male	48	26%
Non-binary	0	0%
Would rather not say	8	4%

What is your household income?

INCOME	QUANTITY	PERCENTAGE
Under $24,999	8	4%
$25,000-49,999	11	6%
$50,000-74,999	13	7%
$75,000-$99,999	28	16%
Over $100,000	80	44%
Would rather not say	40	22%

Survey participants were also asked to identify their home location on a map of the study area. The results are illustrated in Figure 2 below.

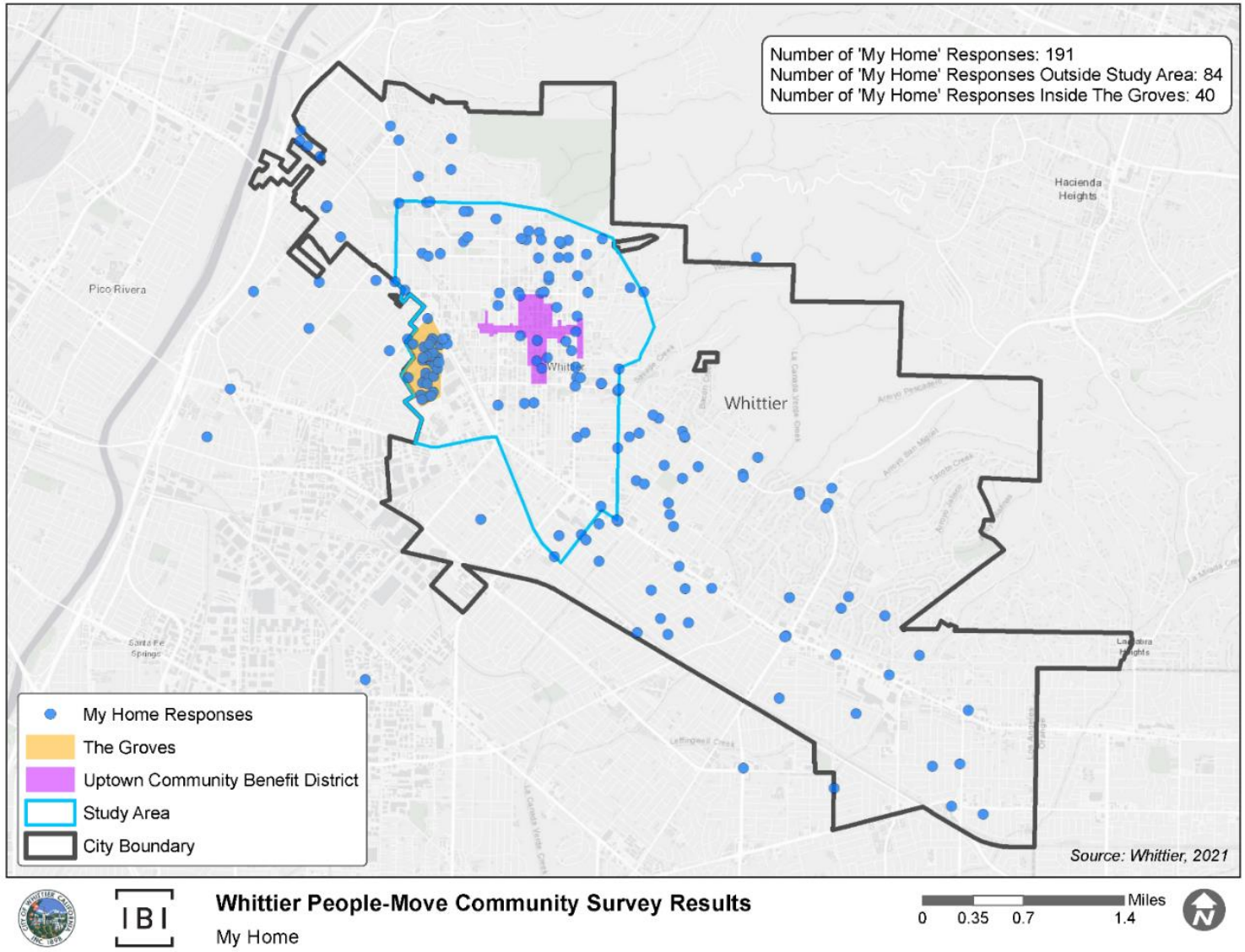


Figure 2: Home Locations Map

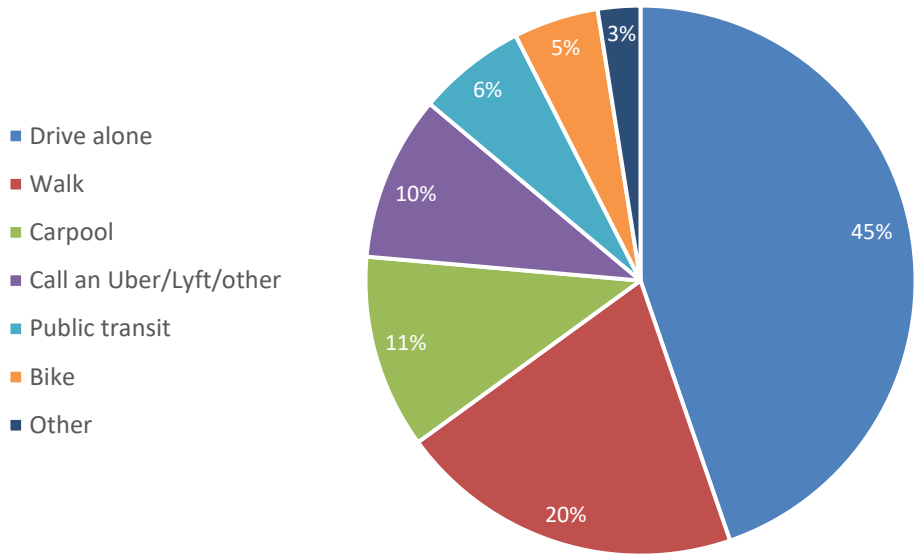
2.2 Mobility Questions

The survey contained several questions about how people currently travel in and through Whittier, what barriers to mobility they currently face, and what improvements they would like to see in the future.

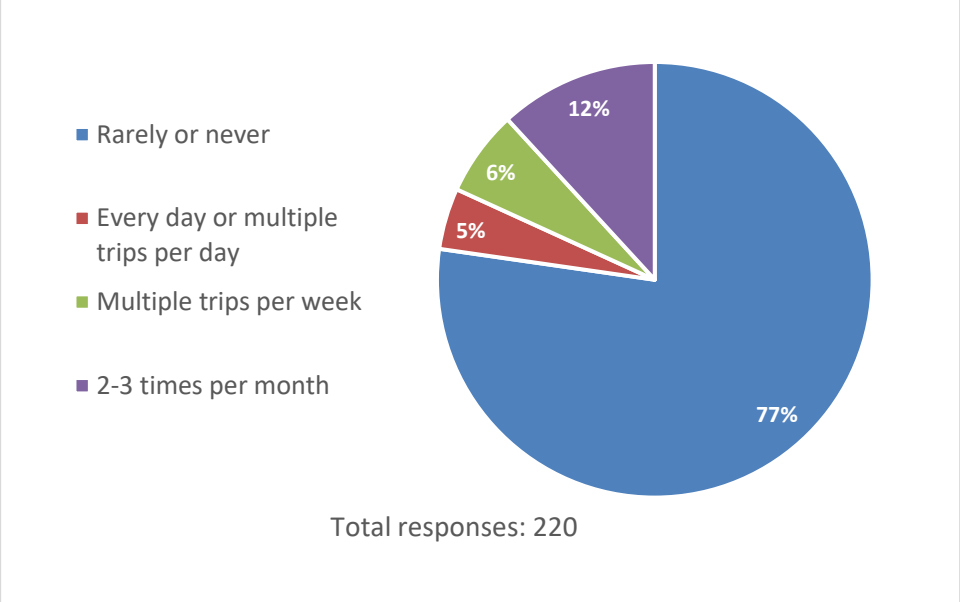
Do you travel in and around Uptown Whittier?

RESPONSE	QUANTITY	PERCENTAGE
Yes	166	92
No	14	8

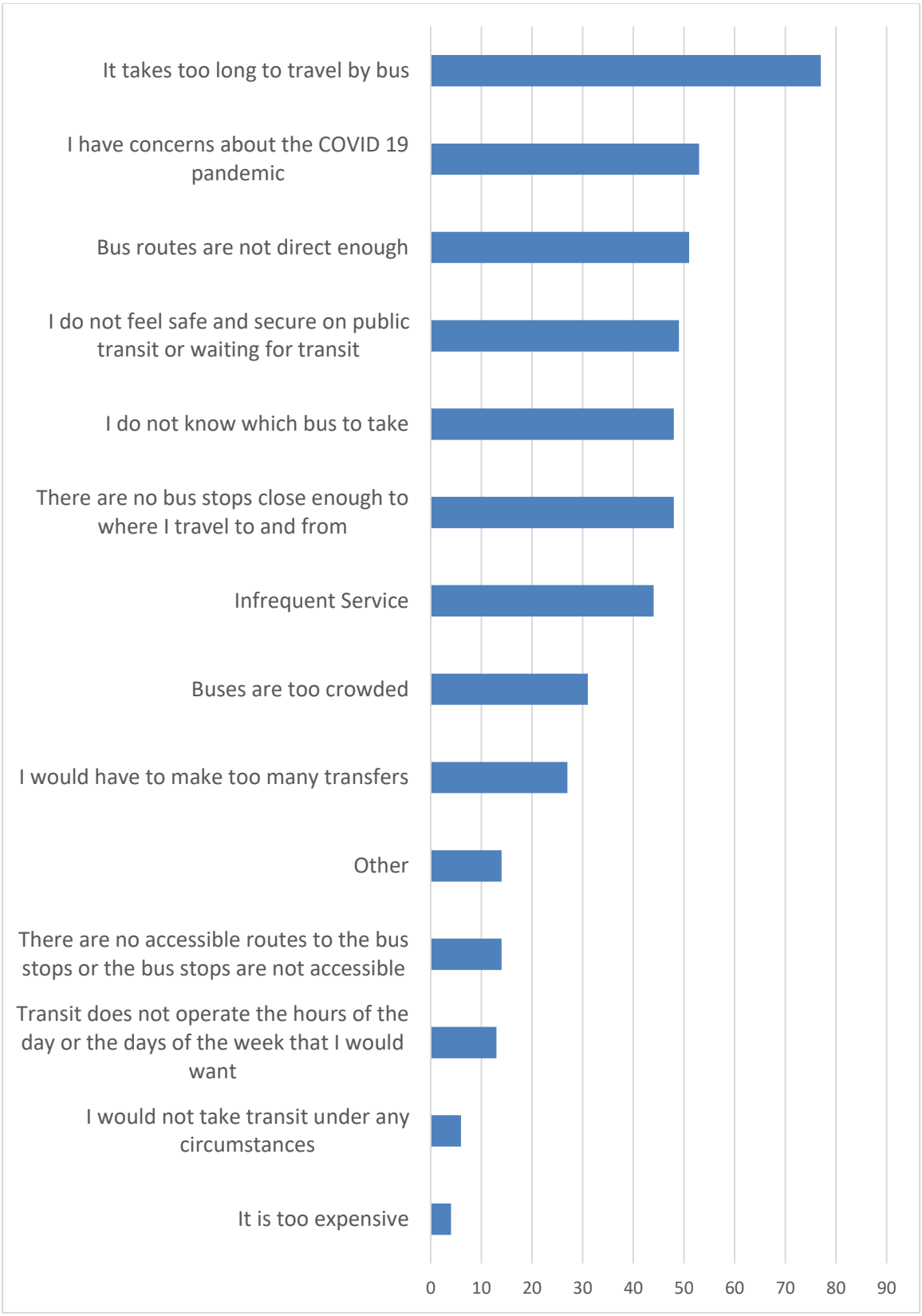
How do you typically travel?



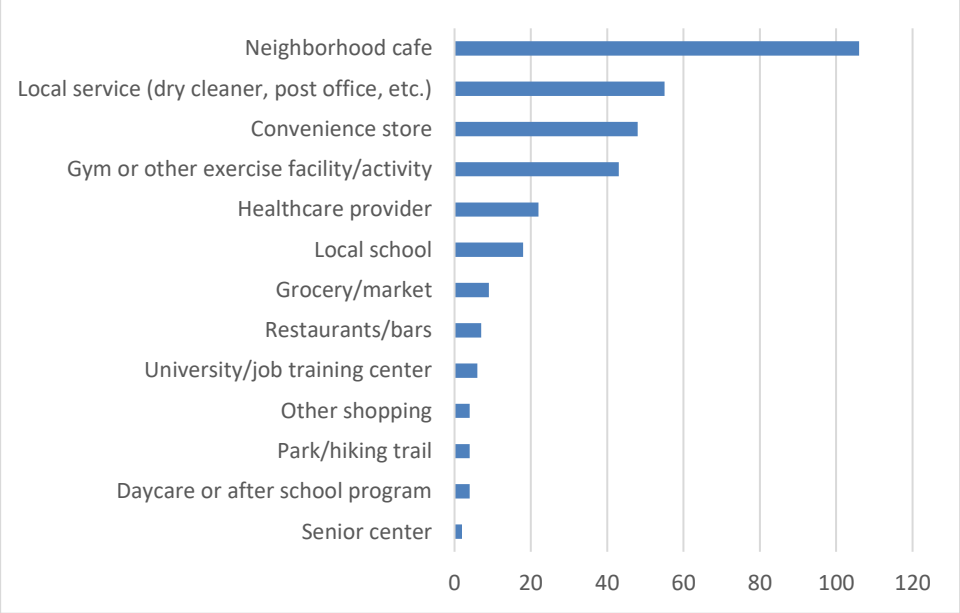
If you selected public transportation above, how often do you travel using public transportation?



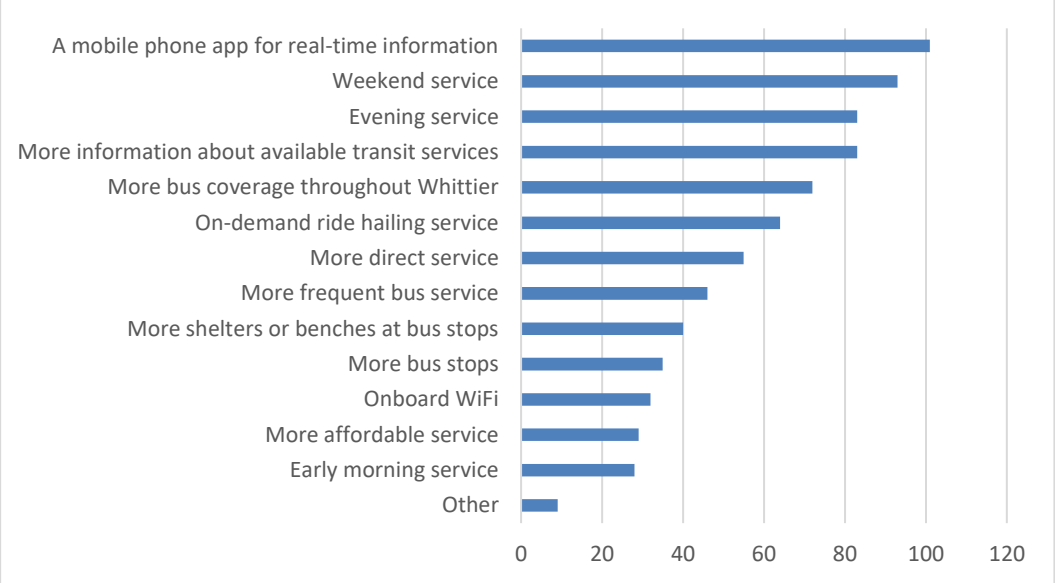
If you do not use public transit, why not?


It takes too long to travel by bus
I have concerns about the COVID 19 pandemic
Bus routes are not direct enough
I do not feel safe and secure on public transit or waiting for transit
I do not know which bus to take
There are no bus stops close enough to where I travel to and from
Infrequent Service
Buses are too crowded
I would have to make too many transfers
Other
There are no accessible routes to the bus stops or the bus stops are not accessible
Transit does not operate the hours of the day or the days of the week that I would want
I would not take transit under any circumstances
It is too expensive
0
10
20
30
40
50
60
70
80
90

If you could replace one car trip per week with walking, biking, or public transit, where would you go?



Which of the following types of mobility improvements would you like to see?



Have your travel patterns changed during the pandemic? If so, how so?

Survey respondents were given five options from which to choose such as “I now work from home or follow a hybrid schedule” or “I use my private vehicle more than I used to.” All of the individuals who responded selected the “Other” option rather than one of the pre-filled responses. Of the 17 responses received, some themes included:

- Needing the flexibility of a car to drive one’s self
- Concerns about safety/crime on public transit

- Openness to taking public transit, especially as one ages

2.3 Mapping Questions

Survey participants were shown a map of the City of Whittier, Uptown Community Benefit District, and The Groves, and asked to identify travel destinations (work, school, recreation, shopping/errands, medical and public facilities, friends/family), other destinations, and existing gaps in the service network. The locations of these destinations and gaps are shown in Figure 3 and Figure 4 below.

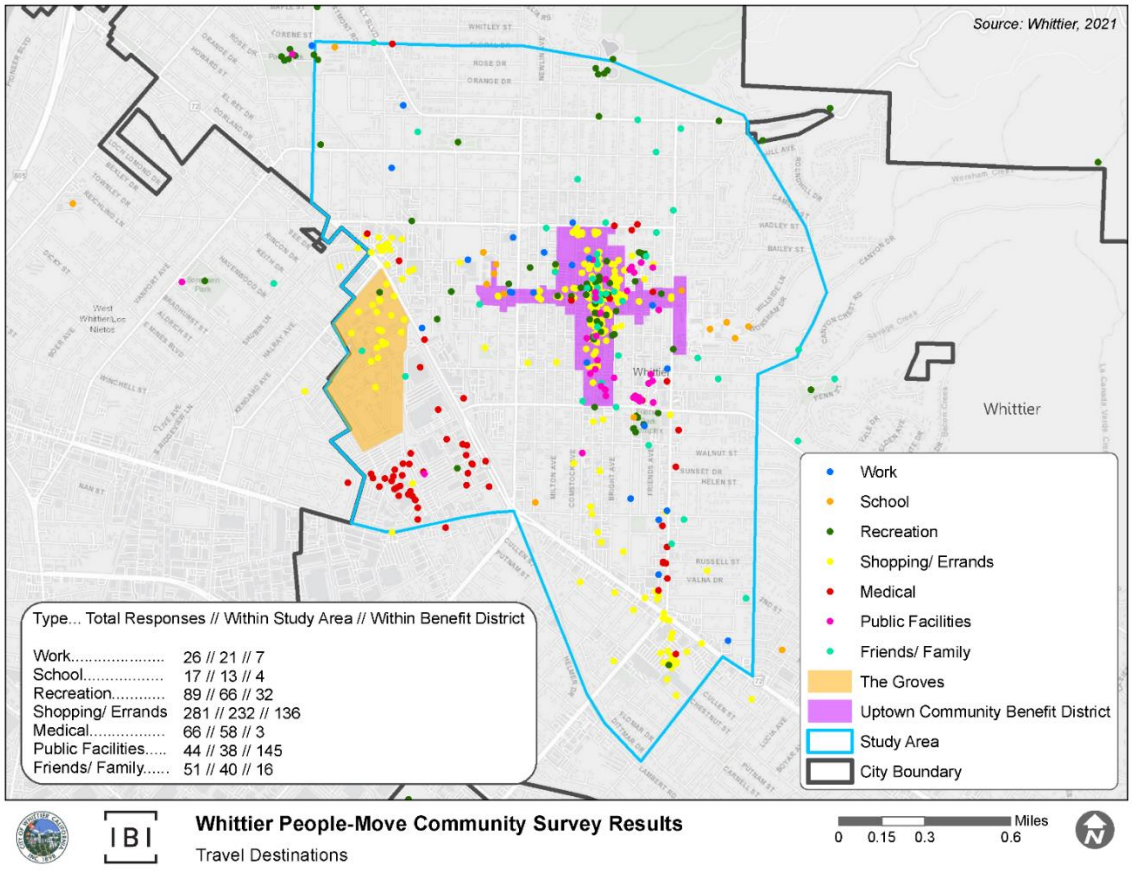


Figure 3: Travel Destinations Map

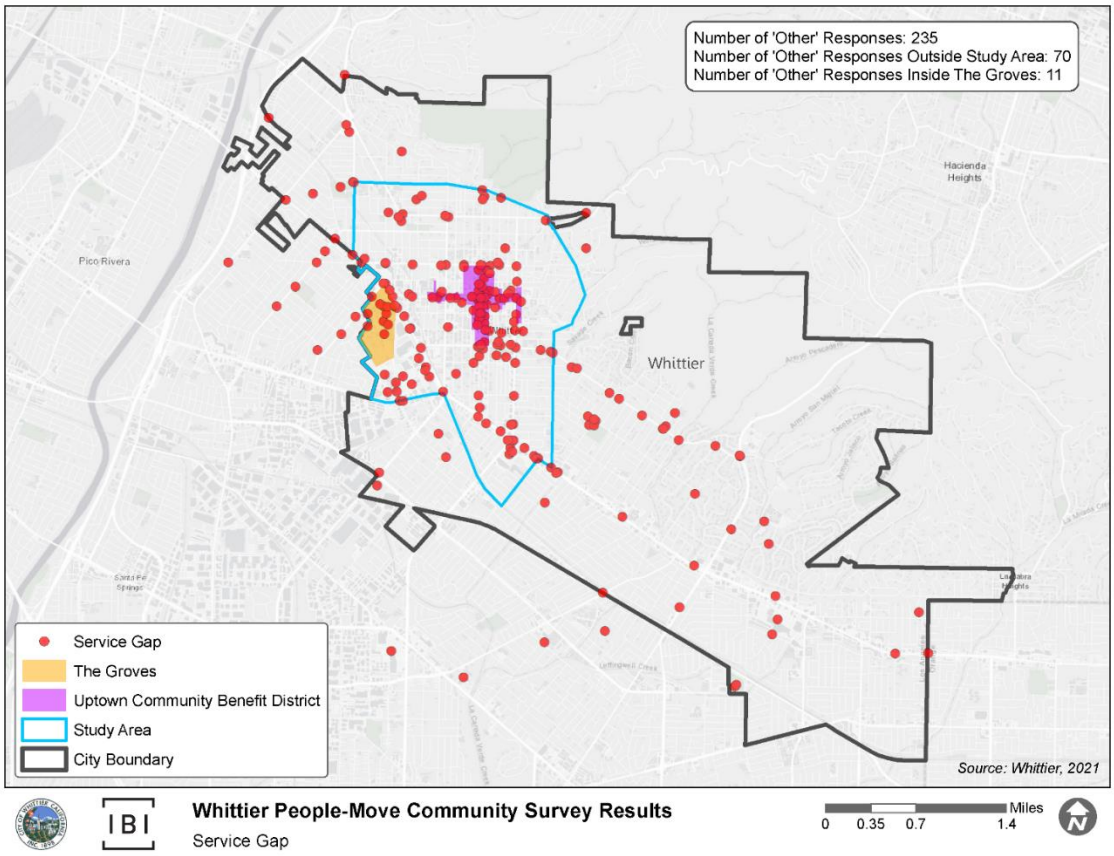
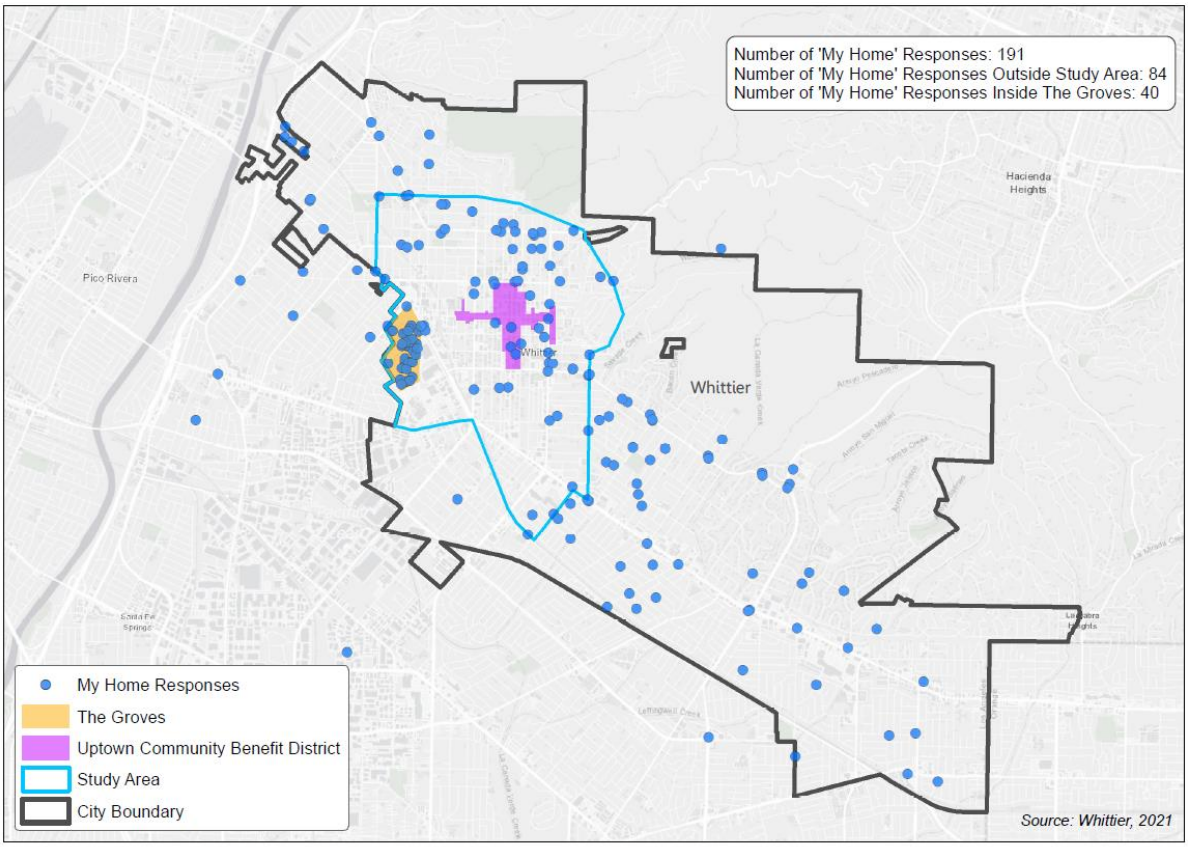


Figure 4: Service Gap Locations Map

3 Key Takeaways

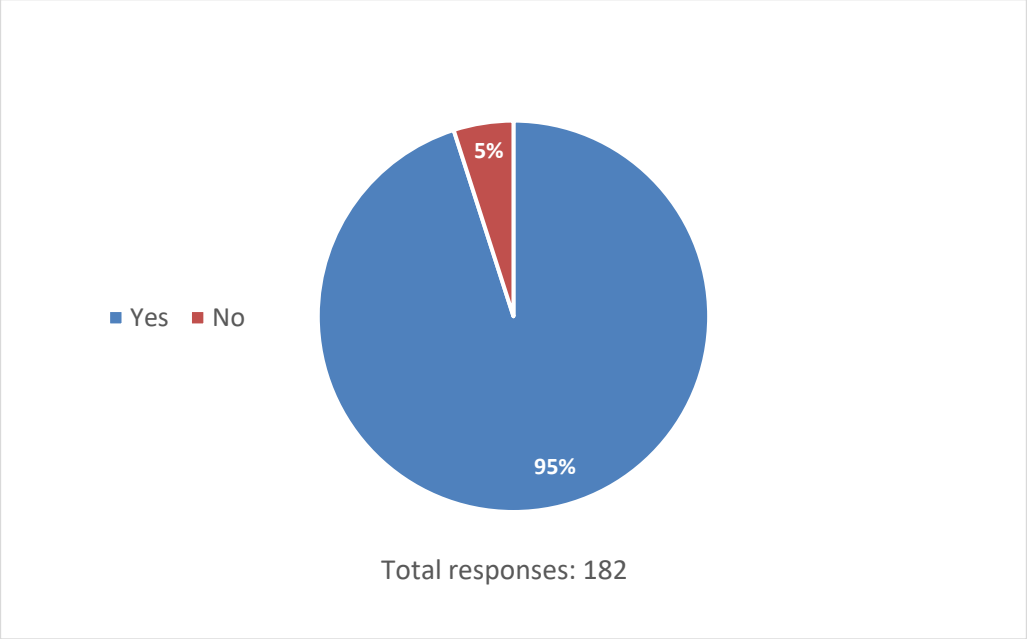
Takeaway 1: We heard from residents across a wide distribution of Whittier.

Approximately 20% of respondents live in The Groves, 37% live in the rest of the study area, and 43% live outside of the study area or the City of Whittier.



Takeaway 2: The vast majority of respondents have a car of their own or have access to one.

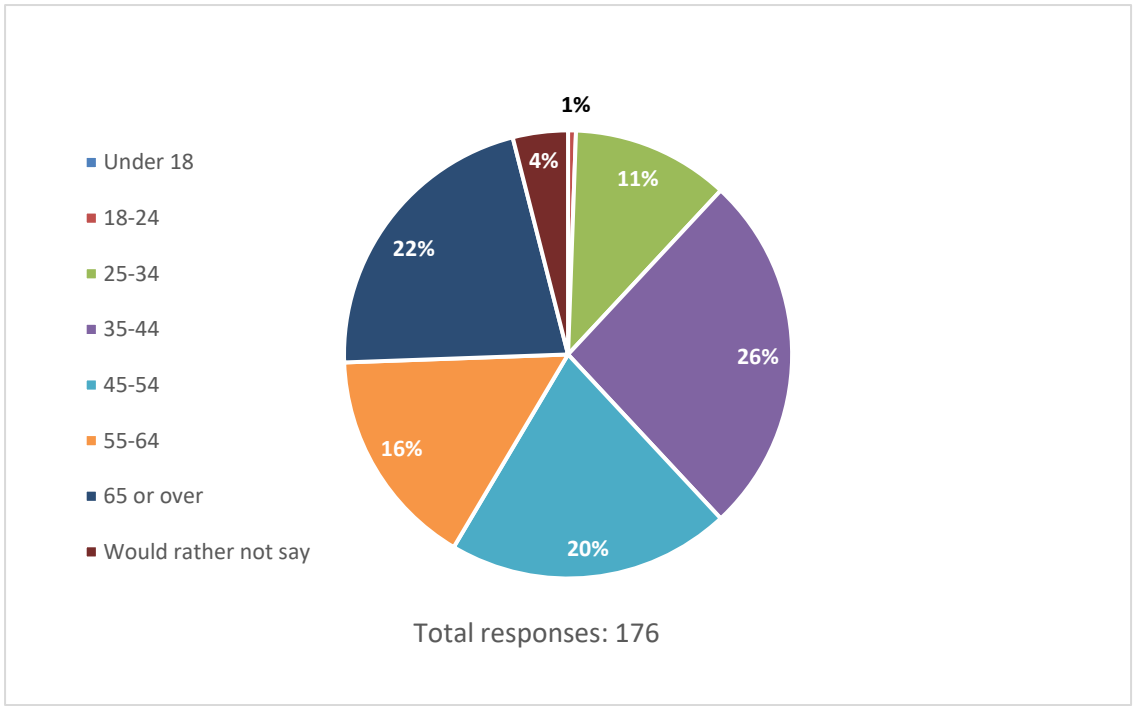
Transit dependent individuals may be underrepresented in the survey results.



Do you have access to a car?

Takeaway 3: Survey respondents skewed older, with the largest proportion (21%) represented being 35-44 years old.

Younger people (under 25) were underrepresented when compared with the City of Whittier demographics as a whole. This means key population groups such as Whittier College students should be targeted in the next engagement activities.

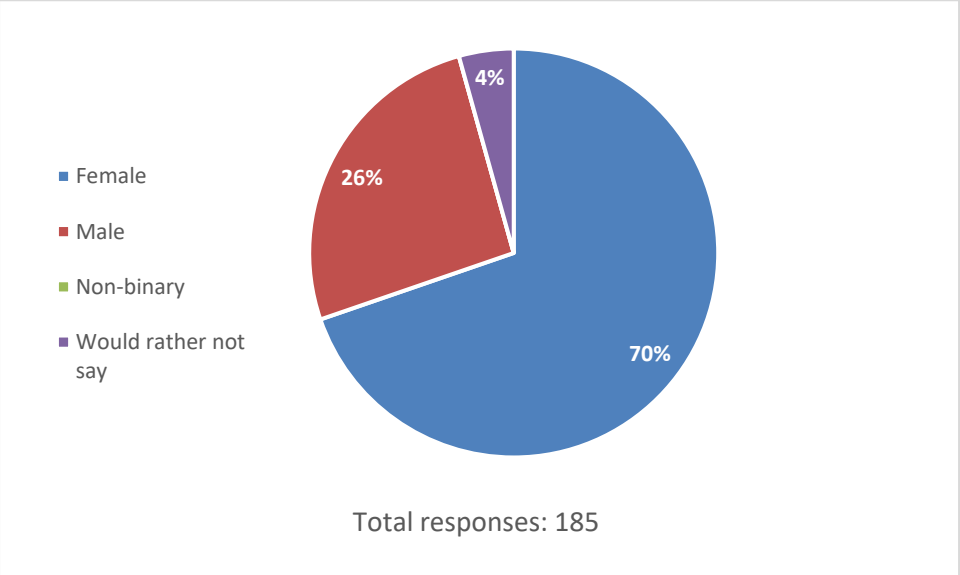


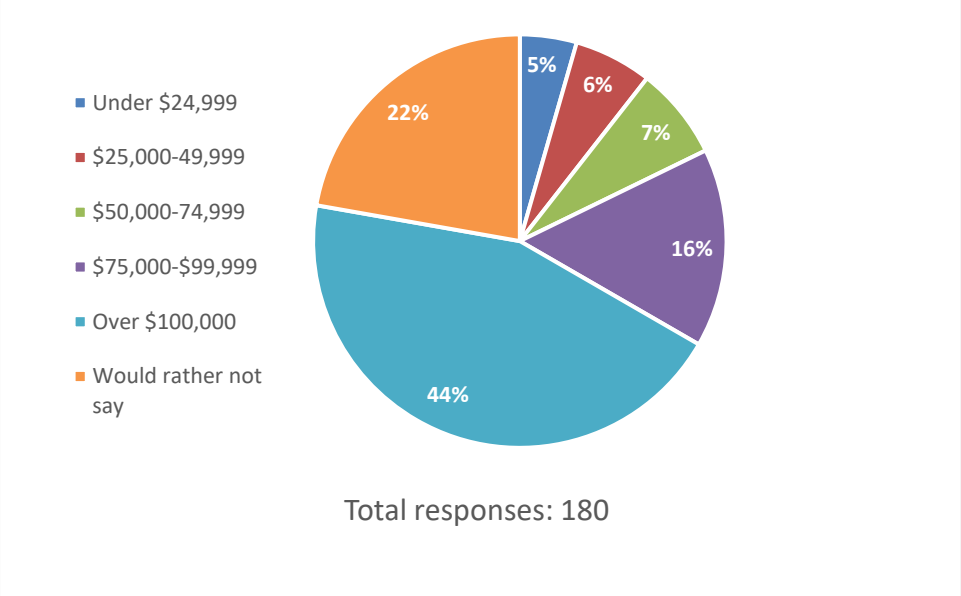
What is your age?

AGE	SURVEY RESPONDENTS	WHITTIER POPULATION
Under 18	0%	24.4%
18-24	0.6%	10.4%
25-34	11.4%	12.1%
35-44	26.1%	15.3%
45-54	20.5%	11.4%
55-64	15.9%	11.9%
65 or over	21.6%	14.5%

Takeaway 4: The majority of respondents were female, high-income residents.

Men and lower-income residents are underrepresented in the responses.

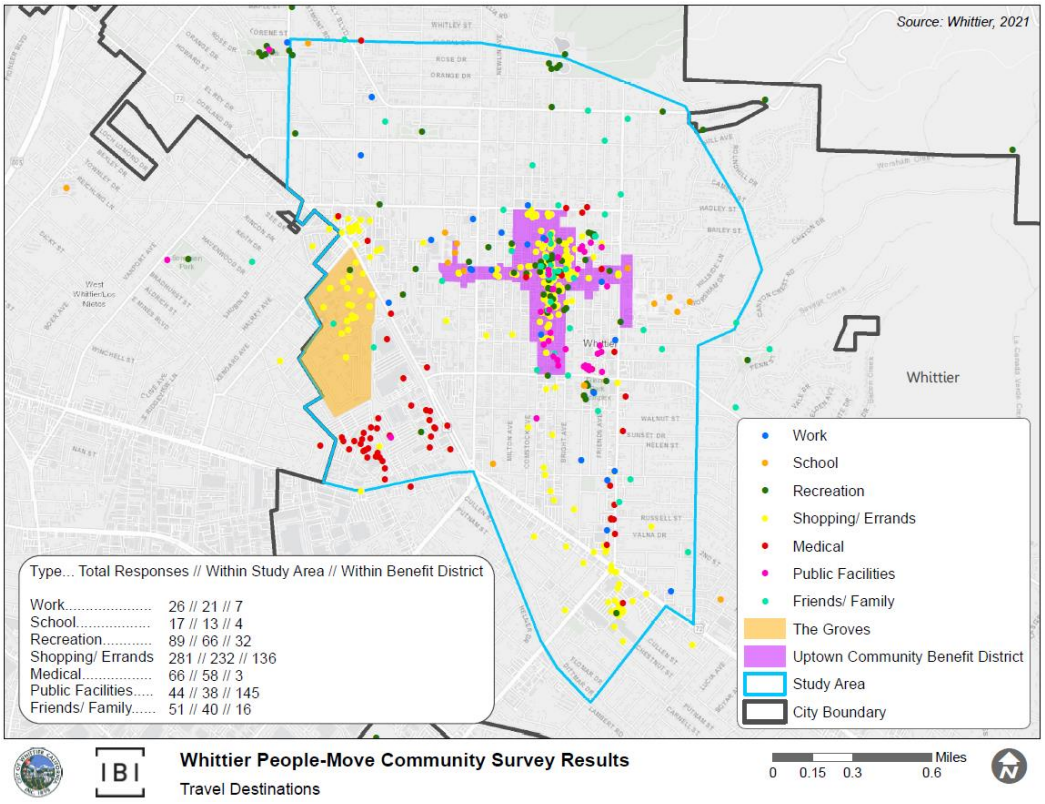




What is your gender and income?

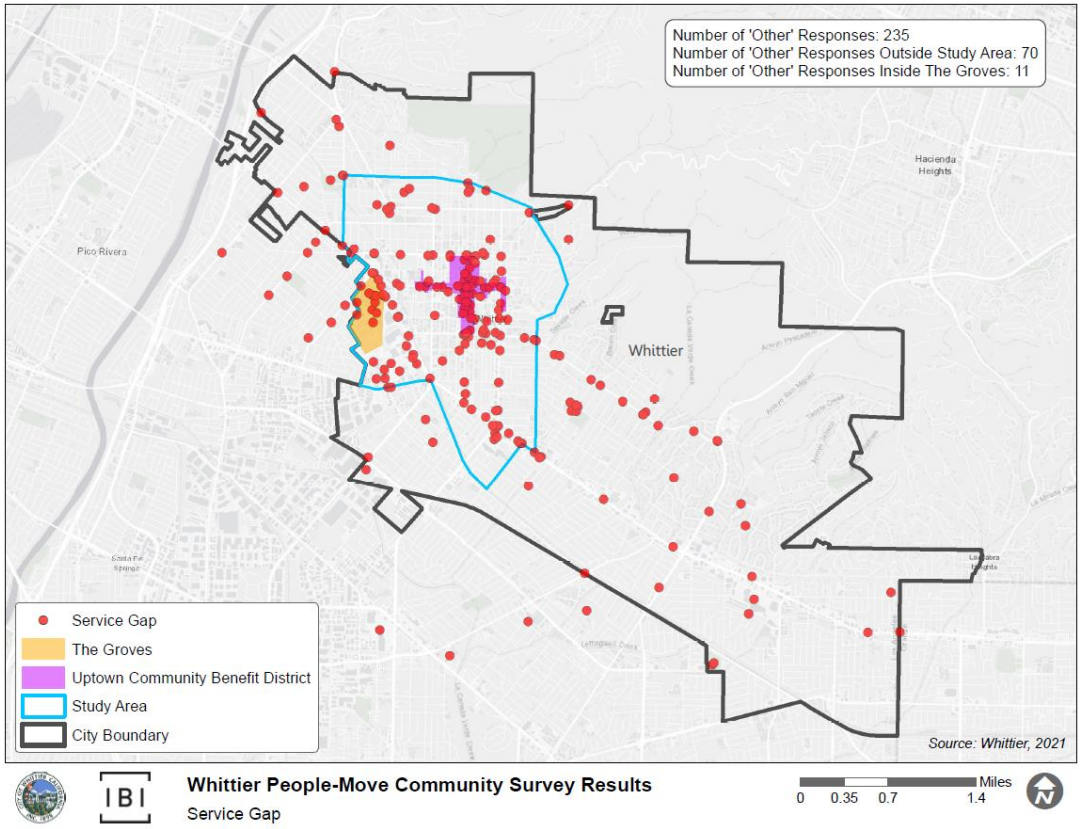
Takeaway 5: Major destinations included The Groves for shopping/errands, Uptown Whittier for a variety of needs, and the PIH Health Whittier Hospital and Kaiser Permanente Medical Center.

This confirms the project objectives to explore improved service to these areas, and highlights community interest in the shops and services along Painter Avenue, Greenleaf Avenue, and Whittier Boulevard.



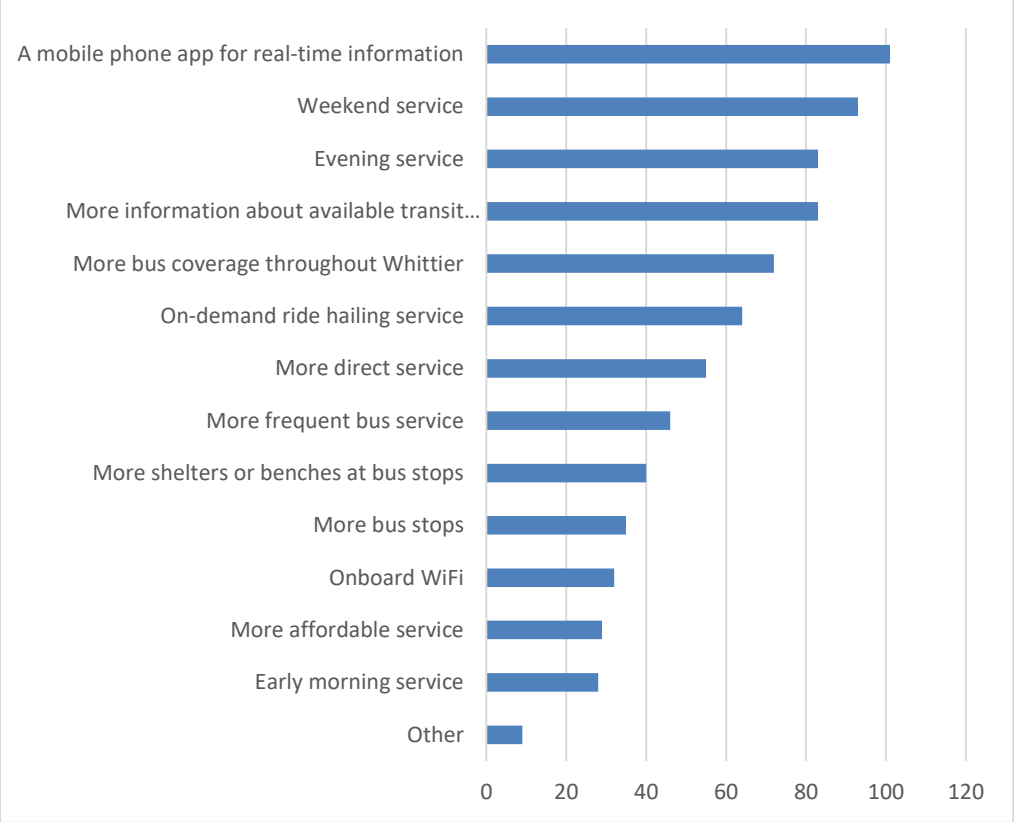
Takeaway 6: Respondents confirmed gaps in service in the Uptown Whittier area, along Whittier Boulevard, and in The Groves.

Nearly two-thirds of responses highlighted gaps in the Uptown Community Benefit District, confirming the need for improved service in the area.



Takeaway 7: People have a desire for many different types of mobility improvements—with 770 inputs received.

Better communication (more information/mobile apps), expanded service hours (weekends, evenings, early mornings), and new connections (through on-demand service or increased bus coverage) were frequently cited.



Which of the following mobility/public transit improvements would you like to see? (check all that apply)

Takeaway 8: Respondents would like to incorporate alternative modes of travel into their routines.

The most popular categories for this question were trips that people take frequently or as part of their daily errands, such as getting coffee or going to the post office.

DESTINATION TYPE	QUANTITY
Neighborhood cafe	106
Local service (dry cleaner, post office, etc.)	55
Convenience store	48
Gym or other exercise facility/activity	43
Healthcare provider	22
Local school	18
Grocery/market	9
Restaurants/bars	7
University/job training center	6
Daycare or after school program	4
Park/hiking trail	4
Other shopping	4
Senior center	2

If you could replace one car trip per week with walking, biking or public transit, where would you go?

Takeaway 9: Respondents are interested in alternative modes for discretionary travel.

The popularity of improved weekend and evening service—along with destinations that are outside of the daily commute—indicates that a flexible mode of travel may meet their needs.

4 Conclusion and Next Steps

Based on the information gathered in this initial round of community outreach, survey respondents are open to alternative modes of travel in the Whittier community. They are interested in technology to help assist them but may need more traditional information and outreach as well.

The input gathered in this report will be used to inform the Task 4 Technical Alternatives Evaluation and Task 7 Project Goals & Performance Metrics. Additional community engagement will also be completed to gauge public support for the potential alternatives. The technical team will explore ways to connect with younger members of the community in particular, as they were underrepresented in the responses to this initial survey.

Appendix 3: Concept of Operations (ConOps)

People Mover Study

Concept of Operations (ConOps)

ARCADIS | IBI GROUP

Prepared for City of Whittier
by Arcadis IBI Group
January 2023

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1 Concept of Operations – *Autonomous Vehicle Pilot*

This chapter presents a concept of operations (ConOps) for deploying autonomous vehicle services in the prescribed study area in the City of Whittier. It includes details related to the possibility of a Phase 1 deployment concept involving AV operations along Philadelphia Street, while offering broad strategies and insights for future phases of the program. The chapter covers proposed concepts and system architecture, and operational considerations, use cases, and scenarios.

1.1 Proposed Concept

1.1.1 Scope

A successful implementation of an autonomous vehicle pilot will consist of two phases: phase 1, the autonomous vehicle pilot, and phase 2, an expansion of the phase 1 pilot to additional use cases.

Phase 1

Phase 1 involves the creation of a replicable and comprehensive AV pilot framework so that Whittier can successfully test autonomous vehicle service in the prescribed study area and be prepared to expand the program to larger scales or additional locations in future phases. Particular emphasis will be placed on developing the systems, processes, and infrastructure for successful service. In this phase, implementation of AV service will be limited to one main thoroughfares within the city – Philadelphia Street providing connectivity between The Groves, Uptown and Whittier College. Limiting the initial pilot to service along this one public street allows for testing and refining operations without major ridership disruptions. This phase is also referred to as the 'City of Whittier AV Pilot Program'.

Phase 2

In Phase 2, opportunities are available to expand the pilot to include additional use cases within the city as well in nearby jurisdictions. The specific additional use cases we consider for Phase 2 are:

1. **First/Last mile service within residential communities**: In this scenario, the City extends service from the public right-of-way (ROW) to private streets within residential communities. The service becomes increasingly utilized as a first/last mile solution for older adults and other residents within these communities, who can now book trips to more tailored locations within Whittier and benefit from door-to-door service. A network of private golf cart paths is now available to potentially help carry riders at safe speeds on a protected ROW. Autonomous delivery vehicles can also be deployed to help with first/last mile delivery.
2. **Expanded access to medical facilities**: In this scenario, service is expanded to allow access to nearby medical facilities such as PIH Health. Riders would be able to book on-demand rides to and from appointments and potentially have medical providers assist with return trip booking as needed. The new expanded medical destinations serve the needs of older adults and people with disabilities who may lack private transportation to this location.
3. **Integrated trip planning and booking with other mobility services**: Embracing MoD principles, trip planning, booking, and payment are offered on one integrated platform for Whittier AV service and other nearby transit services like Metro or Montebello Bus Lines.

Data is shared among multiple regional transit providers and local operators. A joint powers authority governing the platform could be explored as a means of streamlining processes and simplifying information for riders. Users can easily plan and book the most convenient travel possible on a variety of services.

These use cases are not intended to be all-inclusive nor are they set in stone; rather, they illustrate three ways that the City of Whittier AV pilot program could be expanded to garner additional ridership and serve the needs of City residents more broadly.

1.2 Digital Infrastructure

1.2.1 Systems

This section provides an overview of the digital infrastructure related to four main subsystems:

- Traveler-end subsystem
- Central-end subsystem
- Vehicle subsystem
- Wayside subsystem

Each system contains several functions and supporting technologies that are summarized below.

1.2.1.1 Traveler-end: MoD Application

This section describes functions that are utilized by travelers using self-service applications, available via smart devices and web browsers. For smart devices, a MoD application for traveler use will be available via the App Store and Google Play Store. Note that travelers could also utilize kiosk-based interfaces for these functions as well if desired.

Planning

Using current location and desired destination, travelers will see all AV's available to them and the most up to date schedule of service. Routes will be shown on the map along with estimated trip duration. Stop locations will be provided to help guide travelers to the nearest location where they can use the service. In Phase 1, trip planning will be limited to fixed-route AV service, but in Phase 2 there would be opportunities to expand the trip planning tool to include other using modes or connecting to other services for longer trips.

Booking

After planning a trip, travelers will be provided with an option to book a ride. For fixed-route service in Phase 1, this would entail reserving a seat in a vehicle at a given stop location and time (if available). For future on-demand service models, this would allow travelers to request rides from their door. In both cases, the booking system would provide confirmation to travelers and allow them to see when their booked vehicle will be at their boarding location.

Information

Travelers will be able to obtain information on the status of their trips in advance or in real time. Information can be provided on-demand or travelers can opt in to receive notifications based on their preferences. This technology uses sensors inside user devices (e.g., GPS) to provide context sensitive information in real-time. Advance or real-time notifications can be provided in

the form of email, text or alerts using mobile operating system (Android or iOS)-provided push notification features.

Payments

Travelers will be able to pay for trips using their personal device. Payments can be accomplished using payment media stored in customer profiles, using a third-party tokenization service that provides payment tokens for bankcards (e.g., Braintree/PayPal, WorldPay, Visa), or using wallet-based payment method available from third party providers (e.g., Apple, Google Samsung). Mobile payment can also be accomplished via a Traveler's smart device using debiting prepaid accounts linked to their profiles once the trips are completed.

1.2.1.2 Central-end: Mobility Back Office

This section includes functions available to transit staff to help with operations and administration of the AV program. These functions could be expanded in Phase 2 to apply to other use cases as well.

Service Configuration

Administrators will be able to define the parameters of service, including setting up mobility zones, inputting eligibility criteria, and setting up rules of service. In future use cases this may include configuration of microtransit zones, micromobility parking zones, or regulations pertaining to other modes.

MOD Platform

At the core of the central-end system will be a third-party platform that assists with reservations, scheduling, and dispatching. The MoD platform allows for scheduling and rescheduling trips in advance, or in real-time based on a traveler request. The technologies that help perform these functions include a built-in optimization engine to generate optimized runs and trip manifests for drivers. These parameters are based on several parameters (e.g., on-board time, dwell time, street segment travel time). Several products also support real-time optimization that allows a system to perform continuous optimization using relevant system parameters to ensure the most productive utilization of system resources.

Brokerage

Administrators can utilize technologies that allow an application to identify a service provider best suited to provide a trip based on system configurations and traveler needs by brokering trips to third-party providers (e.g., taxis, Uber, Lyft). This would be most applicable in Phase 2 use cases where increased demand meant trips could not be provided using public sector resources or require coordination given expanded use cases.

Transfer Connection Protection

Utilizing this function, administrators would be able to notify drivers to hold vehicles at a stop if another vehicle carrying several connecting passengers was running late. This would be used primarily in Phase 2 when service could be expanded to accommodate longer trips; for example, if passengers were connecting from a delayed Metro or Montebello to a fixed-route autonomous vehicle, administrators could use this function to ensure passengers do not miss their connection.

1.2.1.3 Vehicle-end

This section summarizes information related to technologies to be deployed on-board autonomous vehicles. In Phase 2, these functions could be expanded to include other types of vehicles.

Electronic Manifest Management

Refers to in-vehicle technologies that allow drivers or administrative staff to view upcoming trips, view details of a trip, and communicate on the status of a trip (e.g., pick-up, drop off, no-show) to the central-end mobility back-office. The technology to support this functionality is common available from all demand response service solution providers.

Vehicle Tracking

Certain in-vehicle technologies will be used that allow tracking of location of a vehicle. Typically, it is facilitated by built-in GPS receivers in the in-vehicle hardware. When GPS is not available, this capability is provided using dead reckoning technology which uses vehicle odometer and gyroscope.

Connected Vehicle Subsystem

Connected vehicle technology would allow on-board equipment to communicate with nearby infrastructure, such as an intersection receiver. This could be used by AVs to receive transit signal priority at designated intersections.

Vehicle Automation Subsystem

On-board each AV would be equipment that assists with driving functionality. Defined by the Society of Automotive Engineers (SAE), there are six levels of autonomy; the vehicle automation subsystem could operate anywhere from level three to level five depending on the technology available at the time of implementation. Below (Table 1-1) are the different levels of autonomy.

Table 1-1: Levels of Vehicle Automation

LEVEL	AUTOMATION TYPE	DESCRIPTION
0	No automation	Manual control of a vehicle; human drivers are performing all tasks
1	Driver assistance	The vehicle features offer driver assistance tools such as cruise control or lane monitoring
2	Partial automation	The vehicle can perform assisted steering and acceleration. Human drivers are still responsible for monitoring all tasks and can take control at any time
3	Conditional automation	Vehicle has environmental detection capabilities that inform automated driving. Vehicle can perform most driving tasks but human override can be requested.

LEVEL	AUTOMATION TYPE	DESCRIPTION
4	High automation	Vehicle performs all driving tasks under specific circumstances. Geofencing and/or lane are designation required. Human override is still an option
5	Full automation	The vehicle performs all driving tasks under all circumstances. No human interaction or attention is required.

1.2.1.4 Wayside

Wayside digital infrastructure includes the functions and technologies that help manage physical space in the field of operations. In Phase 1, this would include any relevant intersection technologies and curb management policies. In Phase 2, wayside digital infrastructure could be expanded to include management of mobility hubs as well as street regulation and delineation.

Curb Management

A curb management system would be available to administrators to help designate AV stops, or general zones for pick-up and drop-off. Existing technologies allow for the review of available curb space and communication of designated zones via push notification or platform access.

Mobility Hubs

City administrators in future phases could use this system to help designate mobility hubs which provide a central location for several transit modes. Mobility hubs could also provide solutions to parking management and offer kiosks for booking AV service in future phases.

Street

Supporting technologies on the street would help manage charging for AVs as needed and help regulate AV lane policies that would be established. In future phases, street policies could be expanded to include systems that regulate bus lane enforcement or other street rules.

Intersection

In a distributed transit signal priority (TSP) model, AVs would send priority requests directly to intersection signals. This design type requires less control by the transit management center and allows AVs to benefit from faster travel times along the designated corridor. In future phases, this could be altered to include a TSP TMS that controls signal priority rules throughout a larger area.

1.2.2 Data Management

Table 1-2 presents the types of data are needed to support the systems described above in Phase 1.

Table 1-2: Data Management - Requirements

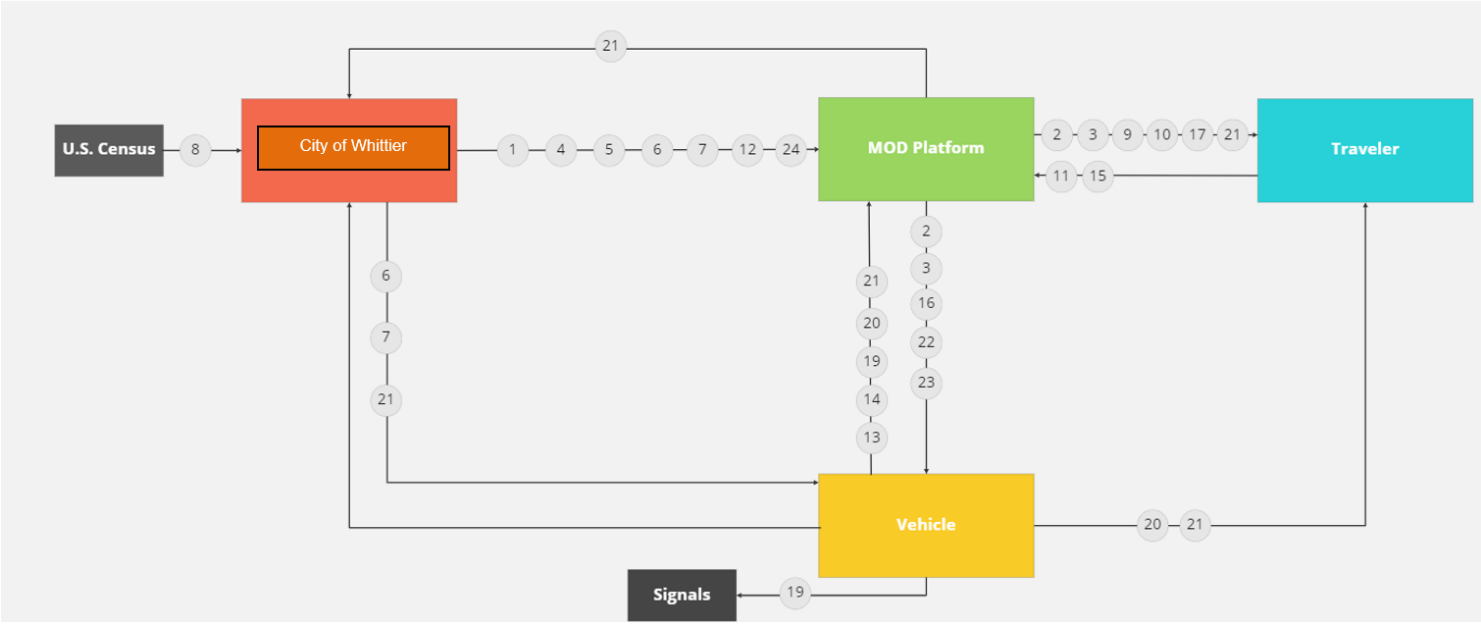
#	CATEGORY	DATA	DESCRIPTION	SOURCE	DESTINATION
1	Eligibility	Eligibility Criteria	Which riders are eligible to use AV pilot service	City of Whittier	MoD Platform
2	Mapping	Street Network	Orientation of roads and associated directions	MOD Platform	Vehicles, Riders
3	Mapping	Travel Time	Duration of a trip	MOD Platform	Vehicles, Riders
4	Mapping	Jurisdiction	Legal boundary within which AV service may operate	City of Whittier	MoD Platform
5	Mapping	Landmarks/ Points of Interest	Locational data about significant specific point locations	City of Whittier	MoD Platform
6	Mapping	Traffic Conditions	Real-time information on traffic on roads	City of Whittier	Vehicles, MoD Platform
7	Mapping	Road Conditions	Updated information on road closures, conditions, construction, or accidents	City of Whittier	Vehicles, MoD Platform
8	Service Planning	Demographic Data	Data on race, age, sex, population, income, and employment	U.S. Census Bureau	City of Whittier
9	Trip Planning	GTFS-Flex	On-demand trip information and service schedules	City of Whittier	MoD Platform, Rider
10	Trip Planning	GTFS-RT	Real-time trip routes and service schedules	City of Whittier	MoD Platform, Rider
11	Trip Planning	Payments	Amount paid for a trip and method of payment that will be entered directly by Riders or drivers into the MOD platform	Rider	MoD Platform
12	Trip Planning	Hours of Operation	Time information on when vehicles will be traveling	City of Whittier	MoD Platform, Rider
13	Operations	Vehicle Charging Information	Status of vehicle's electric battery capacity and range	Vehicle	MoD Platform

#	CATEGORY	DATA	DESCRIPTION	SOURCE	DESTINATION
14	Operations	Vehicle Status	Information related to vehicle trip-readiness and maintenance	Vehicle	MoD Platform
15	Operations	Trip Request	Rider request for a trip from a web or mobile device. Includes trip ID, requesting device ID, device type, pick-up location, drop-off location, pick-up time, and drop-off time.	Rider	MoD Platform
16	Operations	Trip Assignment	Trips are automatically assigned to a specified route	MoD Platform	Vehicles
17	Operations	Trip Confirmation	Platform confirms that a trip has been booked	MoD Platform	Rider
18	Operations	Trip Modification	Rider amends or cancels a trip from a web or mobile device. Includes Trip ID device ID, device type, original/modified pick-up location, original/modified drop-off location, original/modified pick-up time, original/modified drop-off time	Rider	MoD Platform
19	Operations	Vehicle Location	Location and heading along with other details for a vehicle in service made available through the MOD platform	Vehicle	Rider, MoD Platform, Signals
20	Operations	In-vehicle Communications	Data related to safety warning or traffic information within vehicle network	Vehicle	MoD Platform, Riders
21	Operations	Trip Status	Trip-level log of actual time and location for trips on the manifest along with any no-shows and cancellation events made available	Vehicle, MOD Platform	MoD Platform, Rider, City of Whittier

#	CATEGORY	DATA	DESCRIPTION	SOURCE	DESTINATION
			through the MOD platform, including information entered by drivers. Includes trip ID, ETA, and actual time of arrival.		
22	Operations	Delays	Information related to incident delays on road	MoD Platform	Vehicle
23	Operations	Detours	Data related to construction or ad-hoc detours on roads	MoD Platform	Vehicle
24	Curb Use	Curb Management Policies	Information related to City policies and practices regarding curb usage, including vehicle drop off regulations, vehicle stop regulations.	City of Whittier	MoD Platform

Figure 2 illustrates how this data would pass between systems for the Phase 1 AV pilot. Each number on the diagram corresponds with the type of data and number outlined Figure 1-1. Each element that appears in the diagram as a box is discussed in more detail below.

Figure 1-1: Data Exchange for Phase 1 AV Pilot Program



1.2.2.1 Phase 1 Elements

City of Whittier: The City of Whittier serves as a 'center' and refers to the City's existing transportation staff, (contracted) operational facilities, and supporting digital infrastructure such as dispatching software, file sharing services, and servers.

MoD Platform: MoD Platform pertains to the software used by Whittier staff for dispatching, scheduling, and monitoring AV service. It also includes a rider-facing application that allows for trip planning, booking, and fare payment. Because the city does not currently have these features in place for AV service, the MoD platform would serve as a transportation management center (TMS) for these functions.

Vehicle: Vehicles include all transit vehicles being used for AV service in the Phase 1 AV pilot program. Specific vehicle characteristics will be defined as operational components are selected, and data flows will change based on those characteristics (i.e., golf carts, light duty-vehicles, and heavy-duty vehicles could all come equipped with different abilities to send and receive vehicle data.) While vehicles will be developed and sold by a third-party provider, the City of Whittier serves as the owner and operator of these vehicles. Data from these vehicles will be shared with the MoD platform and owned by the city.

Rider: Rider refers to the individuals or groups who are the primary users of the City's AV pilot program. The types of data they will receive via their personal device include trip schedules, real-time vehicle ETAs, trip alerts and notifications.

1.2.2.2 Phase 2 Elements

Integrated Data Exchange: To achieve effective data storage and communication in Phase 2, the project team will need to create a centralized regional datahub for effectively sharing data. The Integrated Data Exchange (IDE) would be a web-based platform that collects data inputted by various organizations and provides access to multi-source transportation data to support the AV program. In this scenario, additional data providers such as Uber or Lyft as well as taxi companies and Metro could be able to access the exchange.

Data being stored in the IDE would include regional trip level data, eligibility requirements, real-time traffic, and real-time transit information. In Phase 2, the IDE could be owned and operated by a joint powers authority such as SCAG (future use case 3) or other service providers.

1.3 Physical Infrastructure

The following sections outline physical infrastructure needed in the Phase 1 pilot, as well as possible future physical infrastructure in Phase 2.

1.3.1 Intersections

- Transit Signal Priority: At intersections, transit signal priority allows for the recognition and prioritization of autonomous vehicles on streets.

1.3.2 Mobility Hubs: Stops/Stations

- Bike racks: At mobility hubs or other stations, bike racks can be implemented to give residents the option to use personal bikes with other modes of available transportation.
- Bike-share station: Post-phase 1, bike-share services offer shared bicycles at a low cost and can be docked at various stations around the city.
- Transit stop: Mobility hubs would also offer transit options offered by LA Metro or Montebello Bus Lines.
- Car-share station: In addition to bike-share stations, mobility hubs could offer car-share stations, in which residents can rent cars short-term and park them at various stations.
- Scooter-share station: Similar to bike-share and car-share, scooter-share programs allow for booking and use of electronic scooters around the city.

1.3.3 Streets

- Charging station: Charging stations would be available at mobility hubs in both Phase 1 and Phase 2 to charge zero-emission AVs.
- Bus-only lane: Post-phase 1, dedicated bus-only lanes could be implemented to give priority to AVs and other modes of public mobility.
- Automated bus lane enforcement: For bus-only lanes, automated bus lane enforcement technologies allow the city to monitor the use of bus-only lanes by permitted and non-permitted vehicles.

1.3.4 Curb Management

- Parking: Locations on curb or near mobility hubs for autonomous vehicle charging and parking when not in use.
- Charging station: Charging stations both on curbs and near mobility hubs to charge zero-emission AVs.

1.4 Operational Policies and Constraints

In planning for the Phase 1 AV pilot program, Whittier will need to further develop operational policies surrounding the use of AVs. Given the differences in level of automation available and several different options for AV and MOD vendors, operational policies will be impacted by vendor selection.

For Phase 1, pilot operations will be constrained to one road: Philadelphia Street; operational policies such as lane use, fixed route stop locations, and driver policies will be developed accordingly. Beyond Phase 1, operational policies will need to consider if lane designation infrastructure is needed or if further geofencing is required. Additionally, as AV technology evolves, policies will need to be adjusted accordingly; current restrictions or policy considerations may not be relevant once technology improves. Similarly, other infrastructure and policies may need to take effect as technology evolves.

As the pilot expands, operational policies will also need to consider community equity impacts. The American Planning Association recommends agencies use best practices for environmental and socioeconomic equity, as well as other principles regarding AV planning.[1]

1.5 Summary of Impacts

This section recaps specific operational changes that will take place as part of the pilot and identifies opportunities for future operational changes and the corresponding impacts they would have.

1.5.1 Service Operations

A new TMS would be established to handle much of AV service scheduling, dispatching, monitoring and reporting. It would require some additional administration, as well changes to service operations for vehicles and operators.

1.5.2 Vehicle

Vehicles would operate on their own at some level but would require supervision and routine maintenance just like other service vehicles. AVs would also require the implementation and maintenance of vehicle charging, including vehicle battery monitoring and modeling. Vehicles would also demand operations changes regarding the installation and use of different onboard equipment, which would also impact maintenance schedules and procedures.

1.5.3 Driver

Operators would also serve in a different role while overseeing AVs. This will depend on the stage of automation. In stages 3 & 4, an operator will still need to be in the vehicle and prepare to perform overrides as needed. In stage 5, no operator would be needed in the vehicle but monitoring of the system would be critical to success.

1.5.4 Streets

Physical infrastructure of streets would need to be altered in future phases; for level 4 automation, this likely requires new striping or lane designation of some kind. The city would need to consider how to best make these changes in a way that ensures the efficiency of the pilot while not disrupting other traffic patterns.

1.5.5 Curbside Infrastructure

The use of zero-emission AVs would require changes in curbside infrastructure to support charging stations, parking, and stops. Kiosks would also need to be implemented for AVs, which would impact planning and operational procedures regarding curbside infrastructure

[1] https://www.planning.org/policy/principles/av/

in the city. Additionally, the City, if implemented, would perform the installation, routine maintenance, and supervision of TSP equipment for the AV pilot.

1.5.6 Charging Infrastructure

Designated chargers would be needed for zero-emission AVs to succeed; this could be plug in or inductive depending on cost and an assessment of service routes and mileage. Charging infrastructure would further impact curb infrastructure, curb policy, and operational procedures.

1.6 Analysis of Proposed Systems

1.6.1 Benefits

This pilot program will have several near-term and long-term benefits for the City of Whittier and the SCAG Region. Phase 1 will be a critical first step to supporting lifelong mobility for senior and disabled populations and establishes the digital and physical infrastructure for increasingly accessible rides.

Phase 2 has an even broader universe of potential benefits, including leveraging Phase 1 infrastructure to pursue MaaS principles, bridge gaps between transportation and healthcare, and solve first-last mile issues in transit within residential communities. In addition, SCAG and other regional municipalities may benefit from the digital infrastructure that is established as part of the project and could use it as a roadmap for other services even outside the scope of autonomous vehicles.

Lastly, the program can also utilize zero-emission AVs, which will provide myriad benefits to the community, such as reduced emissions and reduced road noise.

1.6.2 Disadvantages and limitations

Limitations of the AV pilot program in Phase 1 are primarily low anticipated ridership; because AV service will operate exclusively along two main thoroughfares, it may be difficult for many riders within residential communities to access AVs. Instead, the focus will be placed on proof of concept, and ensuring that policies are in place and operations are effective before expanding it to other areas.

Potential origins and destinations will also be limited in Phase 1, because fixed-route stops will only be on Philadelphia Street. This means that the utility of the service may suffer until additional use cases are added.

Phase 2 should present more opportunities for passengers, but specific options will need to be tailored to regional contexts. This document lays out three compelling future use cases for AV service, however the jurisdiction and goals of the future program will greatly impact their use and incorporation into the mobility options in the SCAG region.

Outcomes of AV service are also dependent on level of available automation. While there are currently level 3 AVs on the road, SAE anticipates levels 4 and 5 might not be available until 2030 or later.[2] This means that an assigned driver would still need to be in the vehicle for Phase 1 program, which increases cost and reduces the appeal of the

[2] https://www.sae.org/news/2022/10/the-autonomous-level-4-horizon

innovative concept. Still, experts believe automation will continue to improve and will take hold in the coming decades.

1.6.3 Alternatives and Tradeoffs Considered

Several alternatives were considered for Phase 1, including providing AV service within residential communities, operating service to and from the Saddleback medical facility, utilizing existing golf cart paths for AV service, and establishing a volunteer network of AV operator/monitors from residential communities. While these ideas would be useful to continue exploring, we determined the scope of Phase 1 would be best focused on establishing infrastructure and proof of concept. Because of that decision, the City of Whittier AV Pilot Program is simplified to operating on public right-of-way.

There are several alternatives that could take hold in Phase 2, each with their own benefits and disadvantages. The three use cases proposed in this document are three of the most compelling ways to expand the program and/or integrate it into the broader transit ecosystem. However, many others could be considered in the future as well. If level four or five automation become tangible, fixed-route bus fleets could be converted to AVs and leverage the same infrastructure being put in place in Phase 1. Opportunities to partner on AV service with other municipalities in the region may grow stronger with time. Local businesses could subsidize AV service in return for stops or virtual stops at their locations. Overall, the opportunities for AV service are numerous, and depending on the technology available at any given stage of automation, the transit landscape could benefit immensely from its utilization in the years to come.

1.7 Ridership Demand Analysis – Automated People Mover (APM)

Figure 1-2 presents a defined a notional fixed route APM service between The Groves and Whittier College. The ridership demand analysis includes a sketch-level estimate of average weekday ridership from available data for the area shown, including trip generation, trip distribution, and mode split. The area was divided into ten analysis zones as shown in Figure 1-2.

The alternative modes assumed to be available were driving, walking, biking, and ride hailing (including taxi); there do not appear to be a meaningful number of local trips which might be captured from MBL Route 10. The results are shown in Table 1-3 for a range of service headways which encompasses those offered on pilot automated services to date. Table 1-3 also shows and estimate of the passenger traffic density (PTD) to facilitate comparison with other data in this memorandum; these values are within a typical range for shuttle services as opposed to local fixed route services with their longer average journeys. The estimated average journey length on this 1.4-mile APM route is about half a mile.

Figure 1-2: Notional Shared Automated Shuttle Route between The Groves and Whittier College

Table 1-3. Notional Demand Estimates for APM					
Mode	**No Service**	**Headway 5 min**	**Headway 7.5 min**	**Headway 10 min**	**Headway 15 min**
Driving	8,418	8,124	8,137	8,147	8,164
Walking	733	708	709	710	711
Ride hail/ Taxi	432	417	418	419	419
Bicycle	265	255	256	256	257
Automated Shuttle	0	343	328	315	296
ASA PTD	0	48,943	46,778	45,056	42,263

Key observations from the above table and its underlying model are:

- The APM could be effective in reducing auto trips within the study area, although would not be likely to transform the local transportation picture in this regard;

- The APM would not be likely to induce large shifts from the non-motorized and ride hail/taxi modes; and
- The operation of the APM would be in a same general vicinity as conventionally operated shuttle services, with average vehicle loads comparable to automated shuttles elsewhere, likely in the range of 0.5 to 1.4.
- The estimated PTD would be in a range where a conventionally operated service would likely operate far fewer trips per day because of the cost of labor, resulting in a higher average vehicle occupancy.

Additional observations from ancillary information/data considered include:

- Conventional local bus services have relatively long average journey lengths and at modest passenger traffic densities achieve productivity by offering lower frequencies which yield favorable passenger loads because of the longer journey length. Montebello Bus Lines (MBL), which operates Route 10 on Philadelphia Street, falls within what might be considered a typical or representative range.
- Fixed route shuttle services perform a variety of functions. Many short routes which connect to specific major attractors or to rapid transit, or which provide downtown circulation, operate within the typical or representative range of local fixed routes. Others which provide area coverage or fill gaps in a network attain markedly lower average vehicle occupancy and physical productivity,
- General-purpose DR services appear to have lower average passenger loads in comparison to fixed-route shuttles. Whittier's Dial-a-Ride (DAR) and DAR Plus services for seniors appear to share this trait, with an average passenger load of 0.37 in FY2021. The pre-pandemic level might well have been two or even three times higher.
- The available data for the relatively small group of automated shuttles which have operated or continue to offer general purpose public urban transit suggest that they have lower average passenger loads than conventionally operated shuttles.